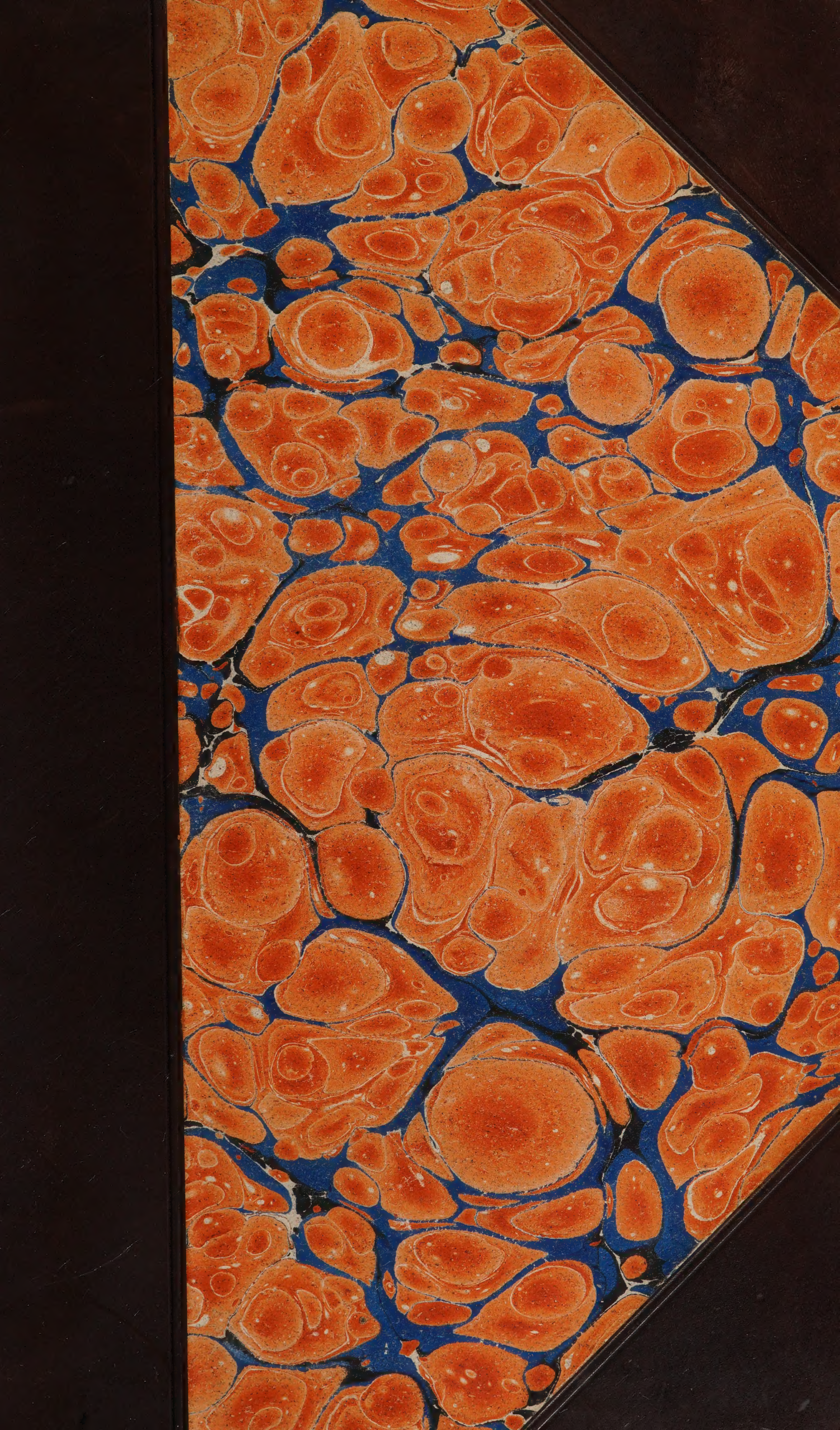

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Vol. 1

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AN ANATOMICAL EXPOSITION OF THE STRUCTURE OF THE HUMAN BODY.

BY JAMES BENIGNUS WINSLOW,
PROFESSOR OF PHYSIC, ANATOMY, AND SURGERY IN THE UNIVERSITY OF PARIS,
MEMBER OF THE ROYAL ACADEMY OF SCIENCES, AND OF THE ROYAL SOCIETY AT BERLIN, &c.

TRANSLATED FROM THE FRENCH ORIGINAL,

By G. DOUGLAS, M. D.

ILLUSTRATED WITH COPPER-PLATES.

IN TWO VOLUMES.

VOLUME I.

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TO

Dr. JAMES DOUGLAS.

SIR,

WHAT I here take the liberty to offer you, is already more your own than mine. To you I owe all that I know, not only of the ſcience, but of the ſtyle of anatomy; and there is not one good line in this tranſlation, which is not the better for what you have taught me, or procured me opportunities of learning. Theſe are very great obligations to a man reſolved to live by the profeſſion of phyſic; but they are very ſmall, when compared with others that you have laid me under, without which I ſhould never have been in a condition to live by any profeſſion. Pardon this public acknowledgment of favours which you deſigned to have kept always ſecret; and continue to believe me, with the utmoſt ſincerity, gratitude, and reſpect,

SIR,

Your moſt dutiful,

Bow-Lane,
Sept. 5. 1732.

Moſt obliged brother,

G. DOUGLAS.

THE

AUTHOR's ADVERTISEMENT.

IN room of a preface which I once intended, the following advertiſement will be ſufficient to inform my readers, concerning the deſign and diſpoſition of this treatiſe, and concerning ſeveral other particular circumſtances which it is proper they ſhould be acquainted with, before they begin to peruſe it.

I entitle this work, *An anatomical expoſition of the ſtructure of the human body*, becauſe my deſign is ſimply to relate that ſtructure, as I have found it by diſſections often repeated, and in different manners; and becauſe I confine myſelf entirely to the human body. I have not enlarged very much on the uſes of the parts; I mention thoſe alone, which appear to me to be well founded on the known ſtructure of the body; and ſometimes I ſay nothing of them at all, as knowing nothing certain about them. In that caſe, I frankly acknowledge my ignorance, in order to excite others who, perhaps, may be more lucky than I have been; and I deſign, in another work, to give a fuller account of theſe uſes.

I have followed the ſame general order which is obſerved by Veſalius in his great work *de corporis humani fabrica*; beginning by the bones, and from thence going on to the muſcles, arteries, veins, nerves, abdomen, thorax, and head, together with the organs of ſenſation; and I more willingly pitched upon this method, becauſe I formerly deſigned to have publiſhed a *Veſalius Renovatus*.

It is for this reaſon, that the particular treatiſe, which I call *A compendious view*, &c. ſect. 7. is placed where, in all appearance, it ought not to be; and that I have been obliged to make this compendious view, partly a recapitulation of the ſections that go before it, and partly an introduction to thoſe that come after.

My great care has been to follow an eaſy, ſimple and inſtructive method, for the ſake of beginners, and of thoſe who have not made any great progreſs in anatomy. I never talk of parts ſuppoſed to be unknown, while I deſcribe the reſt; and I never begin the particular deſcription of any part, without giving firſt of all a general idea of it.

Thus in the treatiſe of the muſcles, I confine myſelf to thoſe which are wholly inſerted in bones, becauſe, in the foregoing ſections, I deſcribed the bones. I mention no muſcles fixed in other organs or viſcera, as for inſtance thoſe of the eye, becauſe that organ was not deſcribed before; and therefore it would be impoſſible for a beginner to underſtand my meaning; eſpecially in naming the particular portions of the eye, in which the ſeveral muſcles are fixed.

I have obſerved the ſame method through this whole work, paſſing always from known parts, to thoſe that are unknown; and I have ſhunned, as much as was poſſible, entering upon particular deſcriptions, till I have firſt communicated general ideas, as may be ſeen by the advertiſements inſerted in each ſection, on this ſubject

It was on this account, that I placed the deſcription of the freſh bones, with all that belongs to them, immediately after that of the ſkeleton; in doing which, I had chiefly regard to the muſcles wholly fixed in bones; ſeveral of which are not inſerted immediately in the bones themſelves, but by the intervention of a ligament, aponeuroſis, &c.

I am apt to think I have done a great ſervice to beginners, in compoſing two particular tables, in order to facilitate the knowledge of the muſcles; one of which ſhews at firſt ſight, in how many bones each particular muſcle is inſerted; the other, to how many muſcles each bone gives inſertion. In the firſt table, each muſcle makes a particular title, under which is a ſimple enumeration of all the bones in which it is fixed: in the ſecond, each bone makes a title, under which is placed a liſt of all the muſcles inſerted in it.

Theſe two tables ſeem to me to be of very great uſe in the practice both of phyſic and ſurgery, by teaching in a moment, thoſe who have not been much accuſtomed to diſſections, to how many ſeveral bones a wounded or otherwiſe diſordered muſcle is connected; and likewiſe with how many muſcles a luxated, fractured, or otherwiſe diſordered bone is connected, eſpecially when, for want of time or of patience, they have not an opportunity of conſulting the whole deſcription of the bone or muſcle concerned.

It is with the ſame deſign, that I have, in the compendious view, &c. given a ſhort enumeration of all the external and internal parts of the human body; adding to each part, a liſt of the principal ramifications of arteries, veins, and nerves, which, in their ordinary courſe, have any relation, connection, or communication, therewith. I deſign hereafter to make theſe liſts more complete, and to diſpoſe them in a better order.

As it was my intention, that this work ſhould be purely dogmatical, and that the facts ſet down in it, ſhould ſtand entirely on the credit of my own obſervations made on human bodies, during many years paſt; I reſolved not to mention a great number of relations, hiſtories, foreign circumſtances, diſputes, quotations, &c. which may be proper enough in treatiſes containing only particular inquiries, obſervations, criticiſms, and ſuch like.

I am however very far from derogating in the leaſt from the merit of any of thoſe great men and faithful obſervers, to whom we owe the numerous fine diſcoveries that have been made, and the excellent writings that have been publiſhed. On the contrary, I had reſolved in a larger work in Latin, to place at the bottom of the pages, a ſort of anatomical chronology, in order to do juſtice to the true diſcoverers, and to ſhew that we are often deceived in thinking we have found out ſomething new.

I have not divided this work into books and chapters, but only into ſeveral treatiſes (or ſections,) the titles of which ſhew what they contain; and I have expreſſed, by other particular titles, the ſeveral parts or articles belonging to the ſubject of each treatiſe. I have, for the eaſe of the reader, divided the text of each ſection, into a great many different paragraphs, and there are likewiſe ſmaller ſubdiviſions, to which I have prefixed a continued ſeries of numbers, which facilitates the references, and will make the quotations from different editions, uniform.

As I was reſolved to have no figures, but what were drawn from the life, under my own direction; and as the impatience of ſeveral perſons, for whom I have the greateſt reſpect, would not allow me time to finiſh the whole ſeries of thoſe which I have already cauſed to be done; I deſigned to make them the ſubject of another work, which will contain at leaſt fourſcore folio plates, with a ſhort explication of each, in Latin and French. But I foreſee that ſuch a work will be beyond the power of any one private perſon.

In the mean time, my friends were of opinion that I ſhould point out, in the ſeveral books of anatomy, the figures which I judged to expreſs each part of the human body in the beſt manner. But I muſt frankly own, that I know but a very ſmall number that are proper for a regular collection, and even theſe are imperfect in ſome parts; and though theſe imperfections may be of very little bad conſequence to good judges; they may nevertheleſs make falſe impreſſions on the imaginations of beginners, as I ſhall ſhew at a proper time, in a diſſertation on anatomical figures in general, and on thoſe of Caſſerius, Euſtachius, Vidus Vidius' &c. in particular; but I know nothing of the Roman edition of ſeven figures of the human nerves, which Riolan commends ſo much in his notes on Veſlingius.

Notwithſtanding all theſe reaſons, which determined me to publiſh no figures at preſent; ſeveral of my friends having inſiſted very much on the neceſſity of my having at leaſt a few, I was obliged, at length, to conſent to copy four of Euſtachius's plates; and as I left them to the choice of my friends, they pitched on thoſe which are here inſerted. I cauſed them to be copied from the Roman originals, explained by the late M. Lanciſi; and to his explications I have added ſome of my own.

Euſtachius had directed particular methods for finding the places in theſe tables which wanted to be explained; but M. Manget, who has publiſhed the whole, at the end of his *Theatrum Anatomicum*, has marked the explications in the common way by letters and numbers. This alteration was approved by Lanciſi, and I have here retained it; Euſtachius's manner not being ſuited to every perſon's capacity.

I formerly contrived the following method for making uſe of thoſe tables with more eaſe. I draw ſquares of five degrees, with black lines, as in the tables *A A*, *B B*, and afterwards complete theſe lines with a red tranſparent liquor, ſuch as the tincture of Brazil wood, on the figures themſelves. Then on each large black and red ſquare I draw twenty little ſquares, with a yellow tranſparent liquor, ſuch as the tincture of ſaffron, as I have done in the table *B B*, by pointed lines. The uſe of this contrivance is to find the upper and lateral degrees to which the numbers in Lanciſi's explications correſpond.

I deſign on ſome other occaſion to give the obſervations I have made on what the modern anatomy has diſcovered to be wanting in theſe tables, which muſt however always continue to be admired by all true and learned anatomiſts. The table *B B* alone was as great a maſterpiece at the time when it was done, as the tables of the nerves, publiſhed by the late famous M. Vieuſſens, ſtill continue to be; for no perſon can ſay that he has hitherto ſeen any better or any ſo good.

I write in a cloſe, conciſe ſtyle; but I have taken all imaginable pains to render it clear and intelligible, and I have ſhunned all obſcure and equivocal expreſſions. I have endeavoured after ſimplicity as well as brevity, and I have continually had theſe two things in view in compoſing this work. For as to brevity, I conſidered that the greateſt number of thoſe for whom I write, want only the eſſential and neceſſary parts of this ſcience; the reſt ſerving only to enhance the price of my book, and ſo to hinder them from buying it.

I ſtudied the other property of ſtyle, ſimplicity, on account of foreigners, whom I muſt have obliged very much, by ſhunning all ſuch Galliciſms as they muſt be apt to miſtake, who are not perfectly acquainted with the genius of the French tongue. Theſe reaſons will, I hope, obtain my pardon from thoſe who love a voluminous, more than a conciſe ſtyle, and from thoſe alſo who do not here find all the politeneſs of which their own language is capable.

Several years ago I was informed, that if I did not publiſh myſelf, what I had ſaid and demonſtrated in my courſes of anatomy, eſpecially in thoſe given at my own houſe, where I often talk without the leaſt reſerve, I ſhould have the mortification to find that ſome other perſon would do it for me. But nothing of this kind was able to perſuade me, either to precipitate a work, which is always much eaſier in the hands of compilers, than in thoſe of the author; or not to behave, in the ſucceeding courſes, with my uſual openneſs of mind. And I was even ſo indifferent about this objection, that I have often corrected with my own hand, what my ſcholars had written during my leſſons and demonſtrations.

Among the great numbers of thoſe who have attended my courſes, I have found but very few that have publiſhed as their own, what they learned from me; and I acknowledge with the utmoſt gratitude, the generous behaviour of many foreigners, in relating in their diſſertations, what they had heard me ſay, either at my own houſe, in the phyſic-ſchools, or at the royal garden where I was employed by the late great M Duvernay, to teach for twelve years, his bad ſtate of health not permitting him to undergo that fatigue himſelf.

And upon this occaſion, I cannot help commending the ſincerity of that gentleman who tranſlated Dr. James Douglas's Engliſh myography into Latin, in declaring in his notes, that I am the author of ſeveral things, which I had only ly mentioned by word of mouth, without having then publiſhed them in print. And this leads me to take notice of another inſtance of ſincerity, of a perſon, who having collected in writing all that he could, during ſeveral of my courſes, put the whole into my hands before he left Paris, with this inſcription: *Hæc tua ſunt*: This perſon was M. L'Archevêque, a phyſician f Rouen.

In the year 1722, I compoſed a treatiſe called *Fundamental Anatomy*, and it was for ſome time before the examiners appointed for that purpoſe; but I afterwards withdrew it, and changed it into this which I now publiſh, which differs very much from the other, both in method and in length. There are a great number of errata, owing to the impatience of the public, which would not allow me time to reviſe the proofs ſo often as I ſhould otherwiſe have done. I beg that theſe faults may be corrected firſt of all, that my expreſſions may not be miſtaken, or errors be imputed to me, of which I am not guilty.

I conclude by acknowledging with ſincere gratitude, that the late M. Steno's diſcourſe on the anatomy of the brain, was the ſole original ſource and general rule of my conduct in all that I have done in anatomy; and I have it inſerted in the deſcription of the head, believing that I ſhould oblige my readers by reprinting a piece which was become very ſcarce, and which contains a great many excellent advices how to ſhun errors and diſcover truth, not only in relation to the ſtructure and uſes of the parts, but alſo in relation to the way of diſſecting, and of making anatomical figures.

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THE TRANSLATOR's

PREFACE.

THE laborious and indefatigable M. WINSLOW, author of this ſyſtem of anatomy, has, in his advertiſement, given us a general view of the plan and diſpoſition of his work My deſign, in this preface, is to point out a little more particularly the excellencies of the original, and then to give ſome account of the rules I have obſerved in the tranſlation.

This work may be conſidered as conſiſting of two parts; an enumeration of phænomena or matters of fact, and concluſions or inferences drawn from thence concerning the uſe or office of the ſeveral parts of the body.

The order which the author propoſes to follow through the whole is, to paſs from known parts to thoſe that are unknown; never to ſuppoſe a part known, or to mention it as ſuch, till it has been previouſly deſcribed; and never to proceed to the particular deſcription of a part, till a general idea has been given of it. This order he has ſtrictly obſerved through the whole firſt volume; but it is not ſo eaſily diſcoverable in all places of the ſecond, and eſpecially in the deſcription of the arteries, veins, and nerves; in tracing the courſe of which, he is obliged to mention many other parts beſides the bones and muſcles, the only parts deſcribed in the preceding ſections. Perhaps he was of opinion that had he avoided this breach of his propoſed order, h muſt have fallen into other greater inconveniencies.

The author's ſimple, eaſy, unconſtrained, and intelligible method of expreſſion, adds a very great beauty to his work, which is not a little heightened by the continued ſeries of diſtinct unconnected numbers, in which each ſection is diſpoſed. I have always looked upon the deſcription of the human body, or of any other part of natural hiſtory, as on a book of geography; the main buſineſs of which is to relate obſervations without ornament, and in ſuch a ſimple manner, as that a perſon who afterwards views the countries deſcribed, may be put in the eaſieſt and readieſt way to ſee what the author ſaw. A laboured elegancy of ſtyle, the beautiful turns of periods, and a ſtudied connection of all the parts of a diſcourſe, will undoubtedly render ſuch deſcriptions moſt pleaſing to a reader of a polite and claſſical taſte; but if he deſigns to be more than a reader, and to conſider his author in another light than as a writer of a romance, that is, if he deſigns to have recourſe to the originals from which theſe deſcriptions were taken; he will ſoon find the difference between the native ſimplicity and the additional ornaments of the deſcriptive ſtyle. Veſalius, the moſt elegant writer in anatomy ſince Celſus's time, endeavoured to imitate Cicero in his diction; but were Cicero to write a ſyſtem of anatomy at this time, he would imitate Celſus or M. Winſlow, and not Veſalius.

In the deſcriptive part of this work, the author has omitted nothing that has hitherto been diſcovered or verified by himſelf, during a very long courſe of anatomical inquiries, to which his whole ſtudy, application, and time have been devoted; and for which his genius is admirably fitted, his encouragement has been the greateſt, and his opportunities the beſt that Europe can afford. And indeed his main deſign appears every where to have been what he himſelf tells us, in the introduction to the hiſtory of the abdomen, to give a full and accurate deſcription of the parts of the human body, without entering very far into the animal œconomy or uſes of the parts.

The general idea, by which he begins the deſcription of each part, ſerves not only for a good definition, but when joined to what commonly follows concerning the figure, ſubſtance, diviſions, *&c.* of that part, leads us inſenſibly into the knowledge of it, and eſpecially lays a foundation for underſtanding its true ſituation in the body; a thing of the greateſt conſequence in anatomy, and in which our author has very much ſurpaſſed all the anatomical writers that have gone before him. This important branch of what he calls the external conformation of the parts, is not only excellently deſcribed in this work, but he has likewiſe every where cautioned beginners againſt the miſtakes that have been or may be committed in diſſections, by deſcribing or delineating the ſituation of the parts from the parts *extra ſitum*. And undoubtedly beginners would do well to render themſelves maſters of theſe more obvious branches of anatomy, and eſpecially of the true ſituation of the parts, before they go on to more minute inquiries, which, in order to produce any real improvement either in phyloſophy or phyſic, muſt be built on the former as on their only ſolid foundation. This is the method followed by M. Winſlow, and no better example can be propoſed for our imitation. No anatomiſt has carried the real knowledge of the inward ſtructure of the parts to a greater length; but he never enters upon that ſubject, till their external conformation has been particularly and accurately deſcribed. Any tolerable judge of theſe matters will hardly be able to keep from laughing, when he hears a young pretender to anatomy talk of making curious injections, of deciding, by means thereof, the diſputes that have ariſen concerning the glandular or vaſcular ſtructure of the brain, or of unfolding the mechaniſm of a lymphatic gland, before he knows what muſcles, large blood-veſſels and nerves lie on any ſide of the arm or thigh, and what ſpace they occupy there, in their natural ſituation. Great pains have been taken to unravel the ſtructure of the different coats of the ſtomach, in order to explain the manner of digeſtion, by perſons who did not know how the two orifices of that viſcus are ſituated with reſpect to each other; and we have ſeen thoſe who have ſpent much time in tracing the different directions of all the fibres which compoſe the heart, before they know how the heart lies in the thorax, or in what direction the great blood-veſſels go out from it.

M. Winſlow not only deſcribes the outward and inward ſtructure of the parts with the greateſt exactneſs, but likewiſe points out the general ways of managing theſe parts in order to ſee what he deſcribes. This is a duty incumbent on every candid diligent anatomiſt, as being the readieſt way to put others in a condition to examine and confirm his obſervations, and to ſave them the time which muſt otherwiſe be unprofitably ſpent in finding out what they might have been eaſily taught by the authors of theſe adminiſtrations: and I think I may venture to affirm, that Ruyſch has loſt more reputation among the ſincere lovers of the progreſs of natural knowledge, by concealing the methods and materials of his injections, than he has gained by the diſcoveries made by them. I am ſorry M. Winſlow has not deſcribed his anatomical encheireſis at greater length; the knowledge thereof being the beſt introduction to the nicer parts of anatomy, on which that of the animal œconomy mainly depends. This ſort of encheireſis is what now goes by the name of experiments, in all the parts of natural philoſophy; and the ſkill in contriving theſe experiments is what puts the chief difference between an experimental philoſopher, who invents methods how to diſcover nature, and a natural hiſtorian who only collects obvious phænomena, or thoſe which cannot well eſcape the eyes, ears, fingers, *&c.* of all who will be at pains to examine them. Obſervations and collections of this kind are undoubtedly of uſe, but it is chiefly by the former that natural philoſophy has been advanced to that pitch at which it is our glory now to find it in Great Britain. " Sir Iſaac Newton" (ſays a very great man) " was ſenſible that ſomething more than " knowing the name, the ſhape, and obvious " qualities of an inſect, a pebble, a plant, or a " ſhell, was requiſite to form a philoſopher, e- " ven of the loweſt rank.——We all of us re- " member that ſaying, ſo frequently in his " mouth, That natural hiſtory might indeed " furniſh materials for natural philoſophy; but, " however, natural hiſtory was not natural phi- " loſophy.——It was not that he deſpiſed ſo uſe- " ful a branch of learning as natural hiſtory; " he was too wiſe to do ſo; but ſtill he judged " that this humble handmaid to philoſophy, " though ſhe might be well employed in amaſ- " ſing implements and materials for the ſervice " of her miſtreſs, yet muſt very much forget " herſelf and the meanneſs of her ſtation, if e- " ver ſhe ſhould preſume to claim the throne, " and arrogate to herſelf the title of the queen " of ſciences."

Before I leave theſe reflections on the deſcriptive part of this anatomy, I cannot help mentioning a few ſmall faults, into which, I think, the author has fallen, and which he might have avoided. The firſt conſiſts in too frequent compariſons of the figure, ſituation, and ſtructure of the parts of the human body, to what belongs to other arts, no leſs unknown than the ſcience of anatomy. I can ſee no neceſſity for ſuppoſing that every perſon who begins this ſtudy, is acquainted with architecture, fortification, joinery, carpenter's work, chemiſtry, *etc.* and I believe all the readers of this book will be convinced that the illuſtrations of the parts of the body taken from theſe arts, are more obſcure than they would have been by a ſimple deſcription without compariſons, or by making uſe of ſuch compariſons only as every one muſt be ſuppoſed to underſtand.

In the next place, the author's way of applying mathematical terms is not altogether warrantable: and as few apply themſelves at this time, either to the chirurgical or phyſical parts of anatomy, without being previouſly acquainted with ſuch parts of mathematics, and of the application thereof to natural philoſophy, as are now univerſally acknowledged to be neceſſary for ſuch ſtudies: I ſhall not be ſurpriſed to hear that beginners are ſtartled, when they read of an irregular circle, or ſquare, of a fibre or line tranſverſely oblique, of a circular oval, *etc.* I muſt therefore beg of them to be ſo indulgent as to believe, that the author, who is a much better anatomiſt than mathematician, deſigned no more by ſuch expreſſions, than that the figures or courſes of the parts which he deſcribes, come nearer to the figures and directions to which he compares them, than to any other.

A third thing in which I think M. Winſlow ſomewhat to blame, is in endeavouring to introduce a great number of new terms of art without any apparent neceſſity. The beſt excuſe that can be pleaded for the numerous terms of art already uſed in anatomy, as well as in the other ſciences, is, that, by the help of theſe, diſcourſe is ſhortened, by expreſſing in one word what muſt otherwiſe have been expreſſed by ſeveral; and for ſuch things as muſt be mentioned very often, ſuch a liberty is not only allowable, but neceſſary. But then, without pretending to fix the exact bounds of this licence, I believe I may venture to affirm, that there is at leaſt a ſufficient number of terms of art to be found in the writers before M. Winſlow, and that the introduction of new terms amounts now to no more than to oblige ſtudents to learn a dictionary by heart; that is, to ſpend that time in the ſtudy of a language, which might have been more uſefully employed in acquiring the knowledge of things.

Another liberty often taken by the author, to ſubſtitute new terms in the room of thoſe hitherto univerſally uſed and underſtood among anatomiſts, is, I think, ſtill more unwarrantable than the former; and the pretence for it, that the common terms either convey falſe ideas of the thing ſignified by them, or do not ſufficiently expreſs the true ideas, is entirely obviated by this conſideration, that all terms are, or ought to be defined, and that the ſignification of them in anatomy ought to be extended no further than theſe definitions allow of. The muſcles, for inſtance, hitherto commonly known by the names of *membranoſus*, *palmaris longus*, *plantaris*, &c. though better deſcribed by M. Winſlow, than they had ever been before, will not in any reſpect be better underſtood by means of his new names of *muſculus faſciæ latæ*, *ulnaris gracilis*, *tibialis gracilis*, &c. Theſe technical innovations have been often complained of by the greateſt writers in other branches of phyſic. Tournefort's ſtrongeſt objection to the famous Moriſon is, that he changes the common names of plants without neceſſity; and Boerhaave, in his ſecond catalogue of plants in the garden of Leyden, deprecates the ſame fault committed by himſelf in the firſt. But it is ſtill more to our preſent purpoſe to obſerve, that even M. Winſlow, who on all occaſions ſhews a very great fondneſs for new terms, owns nevertheleſs, that he is ſometimes obliged to retain the old ones, for the reaſons already given. Thus talking of the muſcles of the fingers and toes, he tells us, that though he gives up all names taken from the functions commonly attributed to muſcles, yet the names taken from the uſes of ſome muſcles may ſtill be retained, *provided they be looked upon as proper names only*; which reaſon may be equally applied to all the old names changed by him, which, as terms of art, ought all to be looked upon as proper names.

What I have hitherto ſaid will be ſufficient to point out, to an attentive reader, the principal beauties and ſlight blemiſhes in the deſcriptive, that is, in the chief part of M. Winſlow's anatomy.

tomy. The inferences or concluſions drawn from the phænomena he deſcribes, come next in order. He tells us himſelf, that he has not much inſiſted on the uſes of the parts, and that he mentions thoſe only which appear to him to be well founded on the known ſtructure of the body: frankly owning his ignorance, as to thoſe about which he knows nothing certain, in order to excite others, who may perhaps be more lucky in diſcovering them than he has been. He likewiſe aſſures us in many places of this work, that it was deſigned to be purely anatomical, that is, to contain an accurate deſcription of the ſtructure of the parts; and only to point out their uſes in general; the farther proſecution of that curious ſubject being referred for another performance. Notwithſtanding theſe repeated declarations of his deſign, I am very ſenſible that his not having inſiſted more on the uſes of the parts, that is, his not having applied his excellent deſcriptions at greater length, to the animal œconomy, is made a heavy charge againſt him by two ſorts of perſons; by thoſe of a philoſophical genius, becauſe they do not here meet with ſo much philoſophy as they expected from an anatomiſt of ſo great reputation; and by thoſe who have been his ſcholars at Paris, becauſe they do not find all that they have heard him deliver on this ſubject in his private courſes. In anſwer to both, we need only obſerve, that, according to our author, the ſolid parts of the body are the chief ſubject of a ſyſtem of anatomy, the fluids being there taken notice of only occaſionally, or as far as is neceſſary to explain the former; and in the next place, that the foundation of a complete phyſiology, is the deſcription of the fluid as well as of the ſolid parts; that is, the nature, properties, motions, *etc.* of the chyle, blood, and all the liquors ſecreted from the blood, are to be inquired into and illuſtrated by hydroſtatical, chymical, and mechanical experiments, before the animal œconomy can be explained. Therefore, in a work deſigned for the explication of the ſolid parts only, the doctrine of the animal œconomy is no farther to be expected, than as the uſes of the ſolid parts can be pointed out, without taking in the conſideration of the fluids. This our author has done, and it is very unreaſonable to quarrel with him for not having done more than his ſubject led him to, or for not having enlarged his ſubject; in chuſing which, every writer has always enjoyed, and ought always to enjoy a full and abſolute liberty. Had he deſcribed the fluids particularly, and afterwards applied the deſcription of the ſolids and fluids to the whole animal œconomy in a healthful ſtate, it might with equal reaſon ſtill have been objected to him, that he ought likewiſe to have given us the hiſtory of all the alterations that happen to theſe ſolids and fluids from various cauſes variouſly applied; that is, that, inſtead of a deſcription of the ſolid parts of the body, he ought to have publiſhed an entire ſyſtem of the theory and practice of phyſic.

Upon the whole, notwithſtanding a few ſmall miſtakes which the author might have avoided, and notwithſtanding all the other objections that have been or may be made to his work, it will be found to contain the beſt ſyſtem of the anatomy of the ſolid parts of the body that was ever publiſhed to the world. This was M. Winſlow's ſole deſign in compoſing it; and, by the help thereof, an induſtrious ſtudent may lay an admirable foundation for underſtanding the animal œconomy, and for the application of that neceſſary part of phyſic, to the knowledge and cure of diſeaſes, which every phyſician ought always to have principally in view in his inquiries into the ſtructure and uſes of the parts.

I am in the next place to give ſome account of the tranſlation I have made of this excellent work. Though ſuch a degree of knowledge of the French, as to be able to read the books written in that language with eaſe and pleaſure, has for many years paſt been reckoned an eſſential part of a polite and liberal education in Great Britain; yet there are a great many people, who, either from inclination or from the way of life which they have choſen, may be ſuppoſed to apply themſelves more or leſs to anatomical ſtudies, without being ſufficiently ſkilled in this faſhionable language. The number even of good French books, imported by our bookſellers, ſeldom over-fond of foreign commodities, is generally very ſmall; and for theſe two reaſons, a good tranſlation of a valuable original ought to be looked upon not only as the moſt proper way to make the original more generally known, but alſo as a new edition of a book with which we could not otherwiſe be eaſily ſupplied. The ſame apology will ſerve for good tranſlations of good books written in all the other living languages.

It is laid down as a general rule, that, in all tranſlations, the author ought to be made to expreſs himſelf in the ſame manner as if he had written originally in the language into which his work is tranſlated. With reſpect to the dead languages, eſpecially the Greek and Latin, I believe this rule will hold; and I dare ſay every reader would be very much pleaſed to find in an Engliſh verſion of Celſus or Aretæus, the ſame beauties which good judges have diſcovered in the originals: but with reſpect to the French originals this rule muſt admit of ſome limitations. Without entering into a particular detail of the different genius of the Engliſh and French languages, or of the writers in each language, it will be ſufficient for my preſent purpoſe to make two obſervations; firſt, that the generality of the French writers think themſelves obliged to expreſs a great many things which the Engliſh leave to be ſupplied by their readers; and ſecondly, that the French words are, in many caſes, ſigns of leſs complex ideas than the Engliſh. From theſe varieties, which might be very eaſily traced to their true ſources, it follows that the French are the beſt writers on the elements of ſciences, and that the Engliſh writings are a great deal more conciſe than the French. M. Winſlow's book confirms what I have ſaid; for as no complete anatomical treatiſe was ever ſo well calculated for beginners, ſo had he lived as many years in London as he has lived in Paris, his book would have appeared in a much ſmaller volume than it does at preſent; and therefore when he tells us that he writes in a cloſe, conciſe ſtyle, he muſt be ſuppoſed to have compared it only with that of the other French writers in anatomy; for when compared with that of the writers in ſeveral other languages, both dead and living, it is certainly very diffuſed. It would nevertheleſs have been an unpardonable liberty in an Engliſh tranſlator to have reduced the original into the ſmall form in which it might have been written by the author in that language; for in that caſe I ſhould have been thought to have given rather an abridgment than a tranſlation of the original. My chief buſineſs therefore as a tranſlator, was to expreſs the author's thoughts in his own way, as far as was conſiſtent with the propriety of the Engliſh anatomical ſtyle.

I have given moſt of the terms of art in Latin, becauſe they are moſt familiarly uſed by Engliſh anatomiſts in that language; and for that reaſon I judge them to be as really Engliſh words as if they had been originally derived to us from the Britons, Saxons, Danes, or Normans; for, after all the efforts made, whether by grammatical or logical pedants, uſe will and muſt remain the ſole ſtandard both for ſpeaking and writing; and Biſhop Wilkins's project for flying to the moon, was every whit as feaſible as that for eſtabliſhing a philoſophical language.

There are ſome words in the original which cannot well be rendered either by Latin or English terms without a circumlocution, or without taking ſome other liberties. *Le trou mentonier* in French ſignifies the external orifice of that canal in the lower jaw which tranſmits the inferior maxillary nerve, or the third branch of the fifth pair: but as there is no adjective either in Latin or Engliſh which anſwers to the French one *mentonier*, that expreſſion cannot be tranſlated without a circumlocution. The word *attache* ſignifies what is commonly called in Engliſh both the origin or beginning, and inſertion or ending of muſcles: but as I could not, conſiſtently with my author's meaning and deſign, uſe theſe Engliſh words, either indifferently or as they have been commonly uſed hitherto; and as there is no one word in Engliſh that I know of, which expreſſes both ſignifications of the original term; I have taken the liberty to affix that meaning to the word *inſertion* by which I have conſtantly tranſlated the French *attache* when applied to muſcles.

On a curſory view of the original, when I firſt undertook the tranſlation, I judged that an alphabetical index would have made a very uſeful ſupplement to this Engliſh edition; and I deſigned that this index ſhould have contained ſhort clear definitions of the principal anatomical terms; and theſe, together with the proper references to the particular ſections and numbers, would have made up a pretty complete anatomical dictionary in a ſmall compaſs. But I ſoon found, in the progreſs of the tranſlation, that ſuch an index would be unneceſſary; for in the firſt place the author has explained the principal terms of anatomy in the beginning of ſection VII. and the various tables which he has given us of the muſcles, arteries, veins, and nerves, together with the particular enumerations of all the parts of the body, all which will be eaſily found by the contents, render any other particular tables or references, in my judgment, altogether ſuperfluous. However, as I promiſed an alphabetical index in my propoſals, if thoſe who have done me the honour to encourage this undertaking, are not perfectly ſatisfied with my reaſons for omitting it; I aſſure them that each ſubſcriber ſhall have one delivered to him gratis, done with all the exactneſs that I am cabable of.

The want of an alphabetical index is one reaſon why this edition does not ſwell to the number of ſheets which I at firſt propoſed; but this is chiefly owing to another cauſe, which it was not in my power to prevent, I mean the ſmallneſs of the character; and this I was obliged to conſent to, that my bookſeller might not be a ſufferer, in caſe the other much cheaper tranſlation, with which we were threatened, had been publiſhed before mine. Whether the undertakers have deſiſted, or not, I cannot tell; but, that ſuch an undertaking was actually ſet on foot, I am fully aſſured upon better grounds than from what was publiſhed in one of the Engliſh journals.

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ROYAL COLLEGE OF LIBRARY VETERINARY SURGEONS

AN ANATOMICAL EXPOSITION OF THE STRUCTURE OF THE HUMAN BODY.

SECT. I.

A deſcription of the ſkeleton, or of the dry bones.

Introduction.

1. THE exact knowledge of the bones is the foundation of all anatomy; becauſe, without this, we can never have a juſt idea of the ſituation, diſpoſition, connection, and uſes of the other parts of the human body, nor conſequently underſtand or cure the diſorders to which they are ſubject.

2. This ſcience is termed *Oſteology*, from a Greek word which ſignifies a diſcourſe or reaſoning upon the bones; and it is ordinarily acquired from a ſkeleton, that is, a collection of bones well cleaned and dried, united together in ſuch a manner as to repreſent, as juſtly as is poſſible, the natural fabric of freſh bones.

3. I ſay as juſtly as is poſſible, becauſe in the freſh bones we obſerve not only the natural conſiſtence and colour of

their different portions, but likewiſe their cartilages, ligaments, membranes, veſſels, *&c.* as will be ſhown hereafter.

4. But ſtill, though the ſkeleton does not come perfectly up to the natural ſtructure of freſh bones, it is both very neceſſary and very uſeful, becauſe we may readily have recourſe to it at all times and in all ſeaſons, in order, firſt, to acquire a preliminary idea of the natural ſtate of the bony edifice, and afterwards to refreſh our memory at our leiſure, eſpecially if we deſire with eaſe and pleaſure to reap the fruit of an examination or demonſtration of the bones in a freſh ſubject, *i. e.* of a particular oſteology, as it may be termed.

5. My deſign is to treat of the bones in both ſtates, beginning by the hiſtory of the bones of the ſkeleton, or the common oſteology. I ſhall next deſcribe the freſh bones taken from dead bodies newly prepared, which, according to Riolan, may be termed *Oſteologia Nova.*

ART. I.

General doctrine of the bones.

Enumeration of the bones.

6. ANatomiſts commonly begin oſteology by the general doctrine of the bones; but as we cannot avoid mentioning ſeveral particular portions thereof as examples of what we deliver in general, it will be more methodical to give firſt an idea of the ſkeleton, by enumerating ſimply all the pieces of which it is compoſed.

7. After this enumeration, I ſhall lay down what relates to the bones in general, and then go on to the deſcription of each dry bone in particular.

8. In another place I ſhall give ſome obſervations on the proportions which bones bear to one another, and on the differences thereof in the two ſexes: But here I ſhall ſpeak only of the dry bones of an adult body, that is, which has reached the utmoſt pitch of growth.

9. The ſkeleton is a regular arrangement or diſpoſition of all the bones, that is, of all the moſt hard, moſt ſolid, and moſt firm parts of the human body, cleared from the fleſh, and dried and connected together either by artificial or natural ligaments.

10. The natural ligaments ſoon grow hard and inflexible; they hide the extremities of the bones, and hinder us from examining each bone in particular: therefore the moſt inſtructive ſkeletons are thoſe in which the pieces are joined by art.

11. The word *ſkeleton*, according to its original, ſeems only to agree to a collection of dry bones: it is however applied likewiſe to thoſe which have been but newly cleaned, and which are connected by the natural ligaments.

12. The ordinary and moſt proper diviſion of the ſkeleton is into the head, trunk, and extremities.

13. The head is divided into two general parts. The firſt is a bony cavity called the *ſcull*; the other conſiſts of ſeveral pieces, which form the greateſt part of the face; and, for this reaſon probably, they have been termed the *face*, though ſome part of the ſcull contributes likewiſe thereto.

14. The ſcull conſiſts commonly of eight bones; one anterior, called *Os Frontis*, or bone of the forehead; one poſterior, called *Os Occipitis*, or the occipital bone; two ſuperior, called *Oſſa Parietalia*, or ſincipital, or parietal bones; two lateral, called *Oſſa Temporum*, or temporal bones; one inferior, called *Os Sphenoidale*, or the ſphenoidal bone; and one interior, called *Os Ethmoides* or *Cribroſum*, or the ethmoidal bone.

15. Beſides theſe we ſometimes meet with ſupernumerary bones, the ſize and number of which vary conſiderably.

16. All the bones which compoſe the face, in the ſenſe already explained, belong to the two jaws, one upper, the other lower.

17. The upper jaw comprehends not only the two large bones named *Oſſa Maxillaria*, from the word *maxilla*, by which this portion of the face is expreſſed, but likewiſe the two Oſſa Malæ, the two Oſſa Unguis or Lachrymalia, the two Oſſa Naſi, the two Oſſa Palati, the two Oſſa Convoluta or lower ſhells of the noſe, and one ſingle bone termed *Vomer*. All theſe amount to thirteen in number, without reckoning the teeth, which are commonly ſixteen.

18. The lower jaw is but one bone, with as many teeth as in the upper.

19. The trunk is divided in three parts; one common, called the *Spine*; and two proper, namely, the *Thorax* or breaſt, and the *Pelvis*.

20. The ſpine is compoſed firſt of twenty-four pieces called

vertebræ, ſeven of which belong to the neck, twelve to the back, and five to the loins; and ſecondly, of the bone called *Os Sacrum*, with its appendix called *Os Coccygis*, or *Coccyx*.

21. The thorax is made up chiefly of the ribs and ſternum. There are twelve ribs on each ſide fixed by the poſterior ends to the vertebræ of the back, the remaining parts of the thorax. The ſeven uppermoſt are called *true ribs*, and the five loweſt *falſe ribs*.

22. The ſternum conſiſts of two or three pieces lying between the anterior ends of the true ribs.

23. The pelvis is principally formed by two great bones called *Oſſa Innominata*, joined anteriorly to each other, and behind to the Os Sacrum, which completes the pelvis.

24. The extremities of the ſkeleton are four in number, two upper, one on each ſide of the thorax, and two lower joined to the two ſides of the pelvis.

25. The upper extremity is divided into the ſhoulder, arm, fore-arm and hand.

26. The ſhoulder is made up of two pieces, one anterior, called *Clavicula*, and one poſterior, called *Scapula*. The arm is only one bone termed *Os Humeri*. The fore-arm contains two, the Ulna and Radius. The hand is divided in three parts; the carpus or wriſt, conſiſting of eight bones; the metacarpus, which is made up of four; and the five fingers, each of which contains three bones, called *Phalanges*.

27. Each lower extremity is divided into the thigh, the leg, and the foot.

28. The thigh is but one bone, termed *Femur*, or *Os Femoris*.

29. The leg is made up of two large bones, named *Tibia*, and *Fibula*, and of one ſmall bone called *Patella*.

30. The foot is divided in three parts; the tarſus, which is made up of the ſeven following bones, the Os Calcis, Aſtragalus, Os Naviculare, Os Cuboides or Quadratum, and three Oſſa Cuneiformia; the metatarſus made up of five bones, and the toes, which are five in number, the greateſt conſiſting of two bones, and the other four of three bones each, called *Phalanges*, as thoſe of the fingers.

31. There are, beſides theſe, ſome ſmall bones which are ſeldom met with in a ſkeleton, *viz*. the Os Hyoides or bone of the tongue, the eight Oſſicula Auditus or bones of the ear, four lying in each temporal bone, the little bone ſometimes

found at the extremities of the apophyſes petroſæ, towards the Sella Turcica, and the ſeſamoidal bones of the fingers and toes, of which two belonging to the great toe are conſiderable enough to be commonly preſerved in ſkeletons.

32. I ſay nothing of a kind of ſeſamoidal bones found ſometimes on the condyles of the femur, at the lower end of the Fibula, at the Os Calcis, and at the Os Cuboides.

33. After this enumeration of the bones of the ſkeleton, it is an eaſy matter to determine their number: to the head belong fifty four, without reckoning the Os Hyoides, and bones of the ear; to the trunk fifty-four, taking the Coccyx for one bone, and the Sternum for two; and to the extremities an hundred twenty-four, leaving out all the ſeſamoidal bones; ſo that the whole number is two hundred thirty-two: to which if we add the eight bones of the ear, and the five principal pieces of the Os Hyoides, we ſhall have in all two hundred forty-five, the ſeſamoidal bones being ſtill left out.

34. Before I go on to the particular examination of each of theſe bones, it will be proper to conſider them in general, with reſpect, (1.) To their external conformation; (2.) Their inward ſtructure; (3.) Their connection; and, (4.) Their uſes.

35. By the external conformation of the bones, I mean all that may be learned about them while they remain entire; ſuch as their ſize, figure, external parts and colour.

External conformation.

36. Some bones are large, as the Os Humeri, bones of the fore arm; Os Femoris, bones of the leg; Oſſa Innominata: ſome middle-ſized, as many bones of the head, the vertebræ, ribs, and bones of the metacarpus and metatarſus: others, in fine, are ſmall; as thoſe of the carpus, of the fingers and toes, the teeth, *&c.*

Size of bones.

37. Some bones are long, as the Os Humeri, bones of the fore-arm, the ribs, *&c.* Some are broad, as the parietal bones, the Scapula and Oſſa Innominata; and there are others in which the three dimenſions of length, breadth, and thickneſs, do not differ much from each other, as the vertebræ, bones of the carpus, patella, *&c.*

Figure of bones.

38. Some bones are ſymmetrical, a certain reciprocal regularity being obſerved between their different ſides; as the Os Frontis, Os Occipitis Os Sphenoidale, Os Cribroſum, Vomer, the lower jaw, the Os Hyoides, Vertebræ, Sternum, Os Sacrum,

crum, and Coccyx. Theſe bones are ſingle, being placed in that ſpace which diſtinguiſhes the right ſide of the body from the left.

39. The reſt of the bones are double or in pairs, whereof one is ſituated on each ſide of the body. Theſe taken ſingly, have not that ſymmetry already mentioned; but when joined to the correſponding bones on the other ſide, they form a regular figure, as we ſee in the parietal bones, Oſſa Humeri, Oſſa Femoris, *&c.* The other varieties remarkable in the figures of bones will be explained hereafter.

External parts of a bone.

40. The external parts of a bone may be divided into one principal, which is as it were the body of the bone; and into four ſubordinate claſſes, termed *regions*, *eminences* or *riſings*, *cavities*, and *inequalities*.

41. The principal part of a bone is commonly termed its *body*, which has been defined to be the middle hardeſt portion, at which the oſſification of that bone begins.

42. But this definition will not hold univerſally; the bodies of the vertebræ, for inſtance, are neither the middle nor hardeſt parts of them, and the oſſification of the Oſſa Innominata does not begin at that portion which is the principal part of them in an adult body.

Eminences of a bone.

43. By the eminences of a bone I underſtand all ſorts of riſings, prolongations, or productions obſervable on its ſurface.

44. Theſe are of two kinds; in the firſt, the riſings are continuous with the reſt of the bone, and make one piece with it; in the other, they are as it were contiguous only, appearing to be parts added to, or united with the body of the bone.

45. The riſings of the firſt kind are termed *apophyſes*, from a Greek word ſignifying *an excreſcence*, becauſe they grow or ſhoot out immediately from the bone itſelf; ſuch are the ſharp eminences of the lower jaw, *&c.*

46. The others are named *epiphyſes* or *appendices*, becauſe they appear to be parts added to the reſt of the bone, and ſtill diſtinguiſhed from it by the intervention of another ſofter ſubſtance called a *cartilage*, the thickneſs of which diminiſhing with age, it becomes at laſt almoſt inſenſible, and is oftentimes quite loſt; ſo that what was an epiphyſis in a

child, has the true appearance of an apophyſis in a perſon full grown; as we ſee in the extremities of the Os Humeri, bones of the leg, *&c.*

47. We muſt here obſerve by the by, that ſome epiphyſes have apophyſes belonging to them, as in the lower extremity of the Tibia; and on the contrary, there are apophyſes which have epiphyſes joined to them, as in the great Trochanter; and the head of the Os Femoris is really an epiphyſes of that part of the bone which is termed its *neck.*

48. Different names have been aſſigned to theſe two kinds of eminences, taken from their figure, ſituation, and uſes.

49. From their figure they are termed *heads*, when they are convex, roundiſh, and ſmooth in their ſurface; *necks*, when they are ſmalleſt at the middle, and grow gradually bigger towards both ends; *condyles*, when two oppoſite ſides of them are flat; *tubercles* or *tuberoſities*, when they are uneven, rough, and irregular; *ſpines* or *ſpinal proceſſes*, when they are ſharp or pointed.

50. The name of *ſpine* is ſometimes given to ſmall tubercles, and alſo to long riſings with ſharp edges, which are likewiſe called *criſtæ.* There are ſtill other names taken from the figure of theſe eminences, which will be met with hereafter.

51. From their ſituation they are called *tranſverſe*, *oblique*, *upper*, *lower*, &c.

52. Some are denominated from their uſes: thus two tubercles in the Os Femoris are termed *trochanters*, becauſe they ſerve to turn that bone.

53. A more particular account of the eminences of both kinds will be found in the deſcription of each bone.

External cavities of a bone.

54. By cavities I mean all the depreſſions perceivable in the outſide of bones. Theſe are in great numbers; very different from one another, and they are called by many different names.

55. They may however be diſtinguiſhed into two general kinds; thoſe which receive ſoft parts, as the cavities which contain the brain, the eyes, the marrow, *&c.* and thoſe which receive hard parts, that is, where the cavity of one bone contains the eminence of another. Theſe laſt are either deep or ſuperficial.

56. Of the deep cavities, ſome are termed *cotylæ*, or *co-*

tyloide, from the reſemblance they bear to a veſſel of that name with which the ancients meaſured liquors; ſuch as the great cavity in the Oſſa Innominata, which receives the head of the Os Femoris. Others are named *alveoli* or ſockets, as thoſe in which the teeth are lodged.

57. The more ſhallow cavities are termed *glenæ*, or *glenoide*, from an ancient Greek word; ſuch as that of the Scapula, which receives the head of the Os Humeri, in the ſkeleton. I ſay, in the ſkeleton, becauſe in freſh ſubjects, this cavity is deeper, as ſhall be ſaid hereafter. Theſe ſuperficial cavities have ſcarce any ſenſible depth, as thoſe in moſt of the vertebræ, in ſome bones of the carpus, tarſus, &c. Some of them are double, as in the upper extremity of the Tibia.

58. The cavities which receive ſoft parts differ from one another, in ſize, figure, &c. The names given to them are theſe:

59. *Foſſa*, when the opening of the cavity is large or evaſated, as the orbits in which the eyes are lodged. When ſuch cavities are ſmall, they are named *foſſulæ*.

60. *Sinus*, when the opening of the cavity is the narroweſt part of it, as in thoſe at the lower part of the Os Frontis.

61. *Labyrinth*, when a cavity has ſeveral hidden turnings which communicate with one another.

62. *Hole*, when a cavity penetrates from one ſide of the bone to the other.

63. *Canal*, or *duct*, when a cavity runs for ſome conſiderable ſpace in form of a tube. The orifices of ſuch cavities are ſometimes called *holes*.

64. When the cavities are very ſmall and almoſt imperceptible, both they and their orifices are termed *pores*.

65. *Slit* or *fiſſure*, where the cavity is long, deep, and narrow.

66. *Notch*, a cavity in the edge of a bone from which a piece appears to have been cut out: *groove*, a kind of half-canal, open, and of a conſiderable length.

67. And when theſe half-canals are ſhallow, narrow, and many of them together, they are termed *ſulci*, or *furrows*.

68. The cavities in which tendons lie, ſuch as that at the upper part of the Os Humeri, are commonly called *ſinuoſities*; and thoſe in which only blood-veſſels and nerves are lodged, as we ſee in the ribs, are termed *ſciſſures*.

69. Theſe two terms are very improper, and the cavities expreſſed by them would be much better named *notches*, or *grooves*. Thoſe through which the tendons paſs, and which are lined with a particular kind of cartilage, might be called *channels*.

70. It is proper to remark here, that when a cavity is called *foſſa*, or *groove*, we have no regard to the ſituation, but only to the figure of the things from which theſe terms are borrowed.

71. Beſides theſe cavities which appear on the outward ſurface of bones, there are others internal, which cannot be diſcovered till the bones have been broken. Theſe we muſt refer to the deſcription of the internal ſtructure.

Superficial inequalities of bones.

72. Among the external parts of bones (No. 40.) I reckoned the ſuperficial inequalities which are to be obſerved in them. Of theſe ſome ſerve for the inſertion of tendons, others for receiving and fixing muſcles: both kinds were formerly termed *impreſſions*, *ſeats*, &c. I have likewiſe choſen to call them *marks*, *ſides*, *traces*, &c. adding the epithets of *ligamentary*, *tendinous*, *muſcular*, or *aponeurotic*, to expreſs their uſes at the ſame time.

73. Theſe inequalities augment the ſurface of ſome bones, and render it proportionable to the extent of a membrane which covers them, called *perioſteum*; of which hereafter.

74. Though theſe inequalities are partly raiſed and partly depreſſed, yet they are too ſuperficial to be ranked among thoſe to which we have given the names of *eminences* and *cavities*.

Regions of a bone.

75. By the word *region*, I underſtand certain portions of the ſurface of a bone, determined in reſpect of extent, figure, ſituation, or other circumſtances.

76. Thus with regard to extent and figure, the long bones are divided into a middle part and extremities; the broad bones into ſides, angles, baſes, and edges. Theſe edges are ſometimes termed *coſtæ*, ſometimes *criſtæ*, and they are ſometimes ſubdivided in two lateral parts called *labia*.

77. With regard to ſituation, bones are divided into the upper, middle, lower, anterior, poſterior, and lateral parts, and theſe again into external and internal, as occaſion requires.

78. But in order to determine theſe ſeveral parts exactly, the natural ſituation thereof ought to be well obſerved, in doing which I ſhall always conſider the ſubject in an erect poſture. And indeed it would be proper that this rule ſhould be extended to all the other parts of the body, that the language of anatomy might be perfectly uniform, and that one perſon, for inſtance, might no longer call that the ſuperior part, which another calls the anterior. Such confuſion may be of very bad conſequence in reports delivered to judges.

79. We muſt likewiſe obſerve, that the words *internal* and *external*, beſides their ordinary and natural ſignification, are taken in ſeveral other ſenſes by anatomiſts.

80. In ſuch caſes I ſhall call that part internal that lies neareſt a plane, which being ſuppoſed to paſs from the crown of the head down between the two heels, divides the body into the right and left ſides; and the part that is fartheſt from ſuch a plane, I ſhall name *external*. Thus the edge of the orbit, near the noſe, is *internal*; that near the temples, *external*.

81. I ſhall obſerve this rule likewiſe in the parts which compoſe the extremities; thus I ſhall call that ſide of the tibia *external* which is next the fibula of the ſame leg, and that *internal* which is next the other leg.

Colour of a bone.

82. The laſt things to be taken notice of concerning the external conformation of bones is their colour, which is not only different in different bones, but in the different parts of the ſame bone; but this obſervation relates properly to freſh bones, and not to the ſkeleton.

Internal ſtructure of bones.

83. All that relates to the internal ſtructure of bones may be reduced to two heads, their ſubſtance and inward cavities.

Subſtance of bones.

84. The ſubſtance of bones is found on examination to be a texture of ſolid fibres differently diſpoſed, according to the particular conformation of each bone. Theſe bony fibres are eaſily diſtinguiſhed on the ſurface of the ribs, where they may be ſeparated much after the ſame manner as we do thoſe of whalebone or horn. We may likewiſe diſcover them by the fiſſures in bones which have been long expoſed to the ſun or air, or any otherwiſe dried.

85. In general, theſe fibres are ſo diſpoſed, as to form in

ſome bones laminæ of a conſiderable extent; in ſome, little plates or ſmall portions of the forementioned laminæ; and in others, filaments of different ſizes.

86. The general ſtructure of the ſubſtance of bones conſiſts in this diſpoſition; and their ſubſtance is partly compact or ſolid, partly cellulous or ſpongy, and partly reticular.

87. The ſolid part lies chiefly towards the outſide of bones, the cellulous part towards the inſide. The firſt is moſt conſiderable in the large hollow bones, the other in thoſe which have no remarkable cavities.

88. The ſolid part is formed by laminæ diſpoſed in different ſtrata. The ſpongy part conſiſts chiefly of the plates and filaments variouſly interwoven: the filaments alone form the reticular texture principally obſervable in the long hollow bones.

89. We may be convinced, that the ſolid part of bones is made up of different ſtrata of laminæ, cloſely joined together, by examining broken bones, thoſe that have been long expoſed to the air, rain, or ſun, thoſe that have been calcined by fire to a certain degree, or thoſe that have been ſoftened by long and violent boiling, as in Papin's digeſter.

90. And even without the help of ſuch preparations, the laminæ in ſome bones may be ſeen through a good microſcope; and ſtill plainer in exfoliations, the coming away of the ſplinters of bones after wounds, *&c.* The number of theſe laminæ anſwers to the thickneſs of the bone.

91. Gagliardi, profeſſor of anatomy at Rome, pretends to have obſerved that theſe laminæ are connected by means of certain ſmall long bones, which running through them in different places, ſome directly, others obliquely, nail them together like ſo many pins.

92. Theſe little bones, he ſays, ſeem to be tranſverſe epiphyſes of the bony fibres, of which the laminæ are compoſed: and that they are of various kinds and figures, ſtraight, crooked, branched, long, and ſhort, and that ſome of them have ſmall heads belonging to them.

93. They appear, according to him, to ariſe from within outward in each lamina, except a few near the outer ſurface of the bones, the points of which are turned inwards in a contrary direction to the reſt: in ſuch a manner as that the nails or pins ariſing from the internal laminæ pierce ſeveral

of thoſe that lie upon them, and each of theſe again ſend out others which pierce thoſe that ſurround them.

94. Laſtly, he ſays, that theſe little bones are not only of different kinds and figures, but of different orders likewiſe, and that they are found in great numbers, even in the cellular ſubſtance of bones. I cannot here take upon me to form any judgment of this doctrine, having been hitherto unable to ſatisfy myſelf ſo much as about the exiſtence of theſe little bones, from all the experiments I have made.

95. To return to the laminæ, the external may be obſerved to lie in pretty regular ſtrata; but in the more internal, this diſpoſition is gradually altered, theſe appearing in ſome meaſure to lie in gathers or unequal folds. The innermoſt of all are perforated by many holes of different ſize and figure.

96. In this manner do the laminæ, which compoſe the ſolid parts of bones, change their regular diſpoſition, to form what I call the cellulous or ſpongy part, which makes up almoſt the whole interior texture of the bones which have not large cavities, and of all the epiphyſes without exception; but in the hollow bones this part is found only near the extremities.

97. The cells or void ſpaces in this ſpongy part are more conſiderable in ſome bones than in others; and the plates which compoſe them differ in form as well as in extent; being more or leſs flat, crooked, twiſted, angular, irregular, thick, thin, broad, narrow, *&c.*

98. In many bones theſe plates appear to degenerate into ſmall filaments, ſo that the cellulous part of ſuch bones is, as it were, a mixture of plates and filaments, repreſenting a kind of fine ſpunge. In ſome bones, a certain regularity may be obſerved in the diſpoſition of them.

99. Beſides the ſmall filaments found in the cellulous part of bones, there is a reticular texture of them in the cavities of ſeveral long bones; the bony threads of which net-work are long, fine, branched, and pliable, and curiouſly interwoven at different diſtances.

100. This reticular texture may be ſaid to ariſe partly from the ſides of the innermoſt laminæ of theſe bones, partly from their extremities, and partly from the cellulous portion. Several ramifications are produced from it, which appear, as it were, ſuſpended in the air, through the whole length of the

cavity of the bone, meeting and uniting together from all quarters, in many places, which, however, are always at a conſiderable diſtance from each other. This texture is very often deſtroyed in taking out the marrow, when bones are deſigned for a ſkeleton.

Internal cavities of bones.

101. Beſides the cavities which appear in examining the external conformation of bones, there are others obſervable in examining their internal ſtructure; which may all be reduced to three kinds, very different from one another.

102. The firſt kind comprehends the large internal cavities found chiefly in the middle of the long bones, which are nearly of a cylindrical figure; ſuch as the Os Humeri, Ulna Radius, Os Femoris, Tibia, Fibula, the bones of the metacarpus, metatarſus, fingers, and toes. In theſe the cavities are proportionable to the length and thickneſs of the bones.

103. The ſurface of theſe cavities is more ſmooth and even in the middle than near the extremities, where they become more rough, unequal, and furrowed, according as the diſpoſition of the laminæ happens to be changed; and bony productions or croſs pieces may ſometimes be obſerved in them, which are either ſingle or combined together in different manners. The reticular texture, already deſcribed, is chiefly found in theſe large cavities.

104. The ſecond kind of internal cavities conſiſts of the cells and intervals in the cellulous portion of bones.

105. Of theſe ſome are large, ſmall, ſingle, double, or more compounded, and of theſe laſt ſome contain ſeveral ſmall ones within them. Others are round, flat, oblong, tubular, oval, angular, ſquare, irregular, *etc.* And of theſe the oblong and tubular lie in directions nearly parallel to the length of the bone. Almoſt all theſe cells communicate with one another in different manners.

106. The third ſort of internal cavities comprehends the ducts and pores found in the ſubſtance of bones.

107. Of theſe ducts ſome are very ſmall, and loſe themſelves in the inner ſubſtance of the bone; the reſt are larger, which having penetrated the ſubſtance of the bone for ſome ſpace in an oblique direction, do afterwards paſs quite through it. Theſe latter are but in ſmall number, and are more ſel-

dom met with in the middle of bones than about their extremities and edges. The former are very numerous, and lie commonly in a direction parallel to the length or breadth of the bone.

108. The internal pores, though imperceptible to the eye, are plainly diſcovered by the yellowiſh matter which tranſudes through bones long kept without being prepared. Havers pretends to have obſerved the particular diſpoſition of them, but I have never hitherto been ſo lucky.

109. All that has been ſaid about the inward ſtructure of bones may be exemplified in the Os Femoris, by ſawing it through the middle lengthwiſe.

110. For thus we diſcover the three different ſubſtances very plainly; the middle part conſiſting of a tube, with thick ſides formed by the compact or ſolid ſubſtance alone; the extremities made up chiefly of the cellulous ſubſtance, and the reticular ſubſtance obſervable in the cavity of the middle part.

111. The laminæ of the ſolid part are gradually ſeparated from one another towards the extremities, being connected by ſmall lateral plates differently diſpoſed in form of cells. From this diſpoſition the laminæ come to be of different lengths, thoſe near the ſurface of the bone reaching to the very end thereof; the reſt, which lie more inwardly, decreaſing gradually in length: Thus the innermoſt lamina is the ſhorteſt; the outermoſt, the longeſt; and the intermediate ones of different lengths between theſe two extremes.

112. For this reaſon the ſolid ſubſtance of the Os Femoris is very thick in the middle, but grows gradually thinner towards each end, appearing there only as a bony cruſt laid over the cellulous ſubſtance. It may likewiſe be obſerved, that the moſt interior laminæ are leſs ſmooth and even than the other, lying, as has been ſaid, in gathers or folds with ſome opening between them, and, in a word, every way irregular.

113. The ſpongy ſubſtance appears clearly enough to be made up of irregular portions or fragments of both the internal laminæ, and of the extremities of all that lie between theſe and the outermoſt.

114. Theſe portions of laminæ, which I call plates, appear in ſome places to have ſomething of a regular diſpoſition:

on: for, from the middle of the bone to its upper extremity, the fragments from the outer laminæ follow nearly the ſame direction with the laminæ themſelves; but in thoſe that lie more inward, and are conſequently ſhorter, theſe plates gradually leave the circumference of the bone, and turn towards its axis, or that line which may be imagined to run in the middle of the bone through its whole length. From this diſpoſition, they ſeem to form ſeveral vaults or hives placed one upon another, the ſmall diſtances left between them being filled by another numerous order of little plates, ſituated ſome more, ſome leſs tranſverſely.

115. Below the middle of the Os Femoris, and towards the inferior extremity, the fragments are more diſpoſed according to the length of the bone, and the little plates which fill up the ſpaces between them are more tranſverſe. It may be remarked likewiſe, that theſe plates in many places, and principally towards the ends of the bone, ſeem to degenerate into ſmall filaments of different ſizes, which, together with the plates from which they ariſe, repreſent a kind of ſpunge.

116. In the cellular ſubſtance of both ends of the bone, ſome marks of the original union of its epiphyſes are often to be ſeen. In children each of theſe marks has a thick ſtratum of cartilaginous matter, which as they grow up becomes gradually thinner and harder, and at length oſſifies. In many ſubjects theſe marks are totally effaced, the epiphyſes then becoming true apophyſes, or at leaſt as difficultly ſeparable from the body of the bone as apophyſes are. In other ſubjects this oſſification remains long without being completed, and thus the epiphyſes may, either by art or accidentally, be looſened and parted from the bone.

117. The Os Femoris furniſhes us with an example, not only of the three different ſubſtances in bones, but alſo of the three different kinds of internal cavities. We ſee one large cylindrical cavity, through the whole length of its middle part; alſo numerous leſſer cells of various figures and dimenſions formed in the interſtices of the cellulous ſubſtance in both extremities; and laſtly, little eyes or holes in the interſtices of the reticular ſubſtance, and where the filaments are mingled with the plates in the ſpongy part. We may likewiſe diſcover the ſmall ducts, which are either diſtributed through the ſubſtance of the bone, or penetrate it all the way to the

marrow. The exiſtence of the inviſible pores is likewiſe demonſtrated, through which the marrow tranſudes, being firſt conveyed through the whole thickneſs of the bone.

Connection of bones in general.

118. The connection of bones is a ſubject which in all ages has occaſioned diſputes, and we find even the beſt authors divided in their ſentiments about it. I ſhall not here give any hiſtory of theſe controverſies, but content myſelf with conveying a ſimple and exact idea of the thing itſelf, by which the reader may be in a condition to clear up and remove miſunderſtandings, doubts, and prejudices, and diſtinguiſh what is true and certain from what is falſe and doubtful.

119. In order to this, we need only conſider well the reſemblance between the ſtructure of the bones, and that of a building; or to make the compariſon more adequate, that of a moving fabric, as a ſhip, coach, clock, or any ſuch other machine.

120. Every one will agree that two things are abſolutely neceſſary to put together all the pieces of which it conſiſts: Firſt, they muſt be ſet in their proper places; and, ſecondly, they muſt be kept there. To ſet them in their proper places, they muſt be exactly proportioned to each other, whether they be deſigned to remain immoveable, as the beams, joiſts, pillars, *&c.* or be contrived for motion, as the doors, windows, wheels, *&c.* Both theſe kinds of pieces are formed into different ſhapes, that they may agree with one another, and all of them together make a commodious ſtructure.

121. The ſeveral pieces being thus adjuſted, are afterwards united together in different manners, by glewing, nailing, jointing, lying, hanging, chaining, *&c.* ſo that the methods, both of putting and keeping them together, muſt vary ſuitably to the form, ſituation, and uſe of each piece.

122. It is eaſy to apply what has been ſaid to the compoſition of the ſkeleton, or rather to the natural fabric of the human bones, which cannot ſerve the purpoſes it is deſigned for, except the ſeveral pieces of which it conſiſts be fitly adjuſted, and then kept together by different ways. The moſt ancient oſteologiſts (ſpeaking only of the perfect bones of an adult) called the firſt of theſe *articulation*, and the other *ſymphyſis*.

123. Articulation thus underſtood is of two kinds; one moveable, by which the bones are allowed a certain degree of motion; the other immoveable, by which they are fixed together without motion. The firſt is commonly called *diarthroſis*, that is, (according to the expreſſion of Carolus Stephanus, an ancient phyſician of the faculty of Paris,) an articulation ſeparated; the other *ſynarthroſis*, or an articulation conjoined.

Articulation of bones.

124. In the diarthroſis or moveable articulation, the pieces are really ſeparate; and the parts in which they touch, are each of them covered by a ſmooth cartilage, by means of which they eaſily ſlide upon one another. In the ſynarthroſis, or immoveable articulation, the pieces are joined in ſuch a manner, as that the parts in which they touch have nothing particular in their ſurface, and cannot ſlide upon each other.

125. There is ſtill another ſpecies of articulation, which cannot well be reduced to either of the two former, becauſe it partakes of both; and therefore I think it neceſſary to eſtabliſh a third kind, by the name of *amphiarthrſios*, which agrees better to this ſort, than to the other articulations, to which it has ſometimes been applied.

126. Diarthroſis is either manifeſt with large motion, or obſcure with ſmall motion. Each of theſe again is of two kinds; one indeterminate, or with motion many different ways, as that of the Os Humeri upon the Scapula, of the Os Femoris on the Os Innominatum; the other alternative, or with motion confined to two oppoſite ſides, as that of the Ulna on the Os Humeri, and of the two laſt Phalanges on the firſt and ſecond.

Diarthroſis.

127. A bone is ſaid to be moveable many different ways, when it can be turned upwards and downwards, forwards and backwards, to the right and to the left, and quite round. The motion quite round is made either on a pivot, that is, about an axis, or in the manner of a ſling, where the bone deſcribes a ſort of cone or the figure of a funnel, one end of it moving in a very ſmall ſpace, the other in a large circle.

128. The firſt of theſe round motions is termed *rotation* by anatomiſts; the other is only a combination of ſeveral motions upwards, downwards, *&c.* And it muſt be remarked,

ed, that rotation is not to be met with in all the articulations for motion many different ways; *e. g.* the articulation of the firſt phalanges with the metacarpal bones, *&c.* does not admit of it.

129. Moreover, this indeterminate diarthroſis is of two different kinds; one orbicular or globular, the other flat or planiform.

130. The orbicular diarthroſis is when the round end of one bone moves in the cavity of another, more or leſs proportionable to it, as the head of the Os Femoris in the acetabulum of the Os Innominatum; or when the cavity in one bone moves upon an eminence in another, as the baſes of the firſt phalanges on the heads of the metacarpal bones.

131. The planiform diarthroſis is when the articulated bones ſlip upon one another, much in the ſame manner, as when we rub the palm of one hand againſt the other: this articulation is found in the bones of the carpus and tarſus, and in the oblique proceſſes of the vertebræ.

132. The ancients called the firſt of theſe two kinds of articulation, *enarthroſis*; the other *arthrodia.* Some modern French writers ſeem to comprehend both, under the word *genou*; a term borrowed from workmen, who, probably, firſt ignorantly took it from the human body, to apply it to their inſtruments. I own that this term, as uſed and explained by them, agrees well enough to all the degrees of the orbicular diarthroſis; but there are undoubtedly many articulations of the other kind ſo very flat, that a ſkilful workman would not allow them the name of *genou.*

133. The alternative or reciprocal diarthroſis bears ſome reſemblance to a hinge, and for that reaſon the ancient Greeks termed it *ginglymus*, which ſignifies the ſame thing; and has accordingly been tranſlated in ſome modern languages.

134. It has been divided into ſeveral kinds; but, properly ſpeaking, I think there can be but two. The firſt is that which is confined to flexion and extenſion; and as in one of theſe motions the two bones always make an angle, I term it an *angular ginglymus.* This is exactly the ſame with the motion of a hinge. The ſecond kind is adapted only to ſmall turns towards each ſide, or to ſmall lateral rotations, in the language of anatomiſts; and therefore I term it a *lateral ginglymus.*

glymus. In each kind ſeveral differences are to be taken notice of.

135. In the angular ginglymus, either each bone partly receives, and partly is received by the other, there being reciprocal eminences and cavities in each, as in the articulation of the Os Humeri with the Ulna; or there are only ſeveral eminences in one bone, received into the ſame number of cavities in the other, as in the articulation of the Os Femoris with the Tibia.

136. The lateral ginglymus is either ſingle, as in the articulation of the firſt vertebra of the neck, with the apophyſis dentiformis of the ſecond; or double, that is, in two different parts of the bone, as in the articulation of the Ulna with the Radius.

137. It muſt in general be obſerved concerning theſe kinds of articulations, that ſome of them are more perfect and cloſe than others; and that they are not all confined to flexion and extenſion, or to the reciprocal turns already explained, as we ſhall afterwards ſee.

138. The obſcure diarthroſis, or that which admits only of ſmall motions, is alſo of different kinds, as ſhall be ſhewn in the particular deſcription of the bones. Examples thereof are found in the articulations of the bones of the carpus and metacarpus, and of the fibula with the tibia.

139. This articulation was formerly called *doubtful* and *neutral*, and by ſome *amphiarthroſis*, while others reduced it to *ſynarthroſis*. The firſt of theſe names might paſs, the reſt are improper.

Synarthroſis.

140. Synarthroſis, or the articulation of bones ſo joined together, as to remain fixed in their ſituation, is of two kinds; one is made by ingrailing, and the other in the ſame manner as a nail or pin is fixed in wood. The firſt may again be ſubdivided into a deep and more ſuperficial kind.

141. The deep kind is obſervable in the articulations of the broad bones. The ancients termed it *future*, becauſe of ſome reſemblance it bears to a coarſe ſeam, as is ſeen in the upper bones of the ſkull. It is made by jags, notches, and holes in each of the articulated bones, by which they are mutually indented, much after the ſame manner as what is called *dove-*

tailing by the joiners. By the ancients it was called *unguis*, probably becauſe the indented pieces are rounded like nails. Sutures have been divided into true and falſe; which ſhall be ſpoke to in deſcribing the ſcull.

142. The other kind is that which is obſerved in bones joined together by more extended ſurfaces, in which no indentation appears outwardly. This the ancients termed *harmony*, and the articulation of ſome of the bones of the upper jaw were given as examples of it. But though they deſcribe it as running in a ſingle line, they did not mean this in a ſtrict ſenſe, but only that the joint was like that of two rough boards without grooves. They have expreſsly told us, that ſome ſmall inequalities might be obſerved in theſe joints; and ſome of them have uſed the terms of ſuture and harmony indifferently.

143. Suture differs very much from harmony. In the firſt, the jaggings and notches are very conſiderable, and the indentation is made likewiſe by ſmall lateral eminences therein; ſo that the bones thus joined, cannot be ſeparated without breaking a great many of theſe jags and their little eminences; whereas thoſe that are joined by harmony, may eaſily be parted without breaking any thing, or at moſt but very little.

144 Harmony differs from ſuture, in that the inequalities therein are very ſmall, their union is ſuperficial, and there is no appearance of them on the ſurface of the bones; the joint there repreſenting only a kind of line, more or leſs irregular.

145. The other kind of ſynarthroſis, an example of which we have in the articulation of the teeth, is called *gomphoſis*, a Greek term ſtill retained. I ſhall deſcribe it in the hiſtory of the bones of the head, to which both theſe kinds of ſynarthroſis peculiarly belong.

Amphiarthroſis.

146. The third general kind of articulation partakes of both the former two, the moveable and immoveable; and for that reaſon I have termed it *amphiarthroſis*, or the mixed articulation; as reſembling diarthroſis in being moveable, and ſynarthroſis in its connection.

147. The pieces which compoſe it have not a particular cartilage belonging to each of them, as in the diarthroſis; but they are both united to a common cartilage, which, being more or leſs pliable, allows them certain degrees of flexibility, though they cannot ſlide upon each other. Such is the con-

nection of the firſt rib with the ſternum, and of the bodies of the vertebræ with each other.

148. Having examined the articulation of bones, we come now to conſider their union or connection, properly ſo called, which the ancients named *ſymphyſis*; taking this term in an improper or large ſenſe; when they applied it to the connection of bones; but in its proper meaning they uſed it only to ſignify oſſification. *Symphyſis.*

149. The authors, who ſay that the ancients took ſymphyſis for a ſpecies of articulation, miſunderſtand them; neither are they more in the right, who advance, that the ancients looked upon articulation and ſymphyſis as oppoſite to each other. If they ſpeak of the moſt early antiquity, both theſe propoſitions are falſe.

150. In the firſt place, the ancients do not confound articulation with ſymphyſis, but plainly diſtinguiſh them, taking articulation for the ſimple ſetting of bones together, independently of their being connected or kept together. In the ſecond place, they do not look upon theſe two as oppoſites, that is, where they talk of articulation, they do not exclude ſymphyſis; becauſe their writings clearly ſhew, that in order to compoſe the ſkeleton, they thought it neceſſary to bring them both in together.

151. The words of Galen alone are ſufficient to prove this. In general he tells us, "That the ſkeleton is a regular diſ-"poſition of all the bones connected together;" and afterwards, "That their compoſition is by articulation and ſym-"phyſis; that articulation conſiſts in the bones being natu-"rally ranked, ſymphyſis in their being naturally connected." In fine, after having enumerated all the differences of articulation, he declares in plain terms, that by ſymphyſis, or the union of bones, he underſtands not only that by which two or more pieces become one by age, but alſo that by which the bones are naturally united and connected together in different ways. Of theſe he reckons three (as his predeceſſors had done), by cartilage, ligament, and fleſh. The firſt kind of ſymphyſis, they call *ſynchondroſis*; the ſecond, *ſynneuroſis*; and the third, *ſyſſarcoſis*. He likewiſe takes notice, that his predeceſſors did not take the word *ſynneuroſis* ſo far in a literal ſenſe, as if it ſignified the union of bones, by means of nerves; but that they were accuſtomed to call both ligaments and tendons by the name of nerves, though

they were very well appriſed of the diſtinction of theſe three things.

152. The diſtinction of ſymphyſis into that without a medium, and that with a medium, can have no place here; for the firſt, of which the lower jaw is cited as an example, belongs not to the connection of bones, but to their formation while imperfect; and therefore may be called *ſymphyſis of oſſification*, and the other *ſymphyſis of articulation.*

153. In another ſenſe, however, this diviſion may ſtill be made uſe of in this manner. All the pieces which compoſe the bony fabric are naturally connected and united together. This union or connection, which, with the ancients, I term *ſymphyſis*, is either without or with a medium.

154. Symphyſis without a medium, is where the articulated bones ſupport themſelves in their ſituation, without any other aſſiſtance than that of their conformation only: thus the parietal bones are mutually fixed by their indentations, and ſo give us at once an example of articulation and ſymphyſis. In the ſame manner the bones in the baſis of the ſkull are ſupported by thoſe which make the convex part of it. In a natural ſtate, however, none of theſe pieces touch one another immediately, but are ſeparated by membranes which run in between them.

155. The connection or ſymphyſis of bones with a medium, is of three kinds; cartilaginous, ligamentary, and fleſhy or muſcular; *i. e.* as the ancients termed them, by *ſynchondroſis*, *ſynneuroſis*, and *ſyſſarcoſis.*

156. Synchondroſis, or the cartilaginous ſymphyſis, is either moveable, as in that by which the bodies of the vertebræ are kept together, or which joins the firſt rib to the ſternum; or immoveable, as that of the Oſſa Pubis, in an ordinary ſtate. The ſymphyſis of oſſification is different from this, and the union of epiphyſis belongs to that, rather than to the ſymphyſis of articulation.

157. Synneuroſis, or the ligamentary ſymphyſis, is found in all the joints deſigned for motion, in the manner that ſhall be ſhewn in treating of the ligaments.

158. Syſſarcoſis, or the muſcular ſymphyſis, is as real as the two former, and may be ſaid to be much more general, becauſe it accompanies and ſtrengthens the others, and ſupplies what is wanting in them. The connection of the Os

Humeri with the Scapula, is a ſufficient proof of this: for the ſtrength and ſecurity of that joint is owing more to the muſcles, than to the ligaments.

159. Before we end this article, it is proper to obſerve, that the word *ſymphyſis*, taken in the ſenſe of the moſt ancient Greek authors, is not more ridiculous or improper than the word *aponeuroſis*, which the moderns continue to uſe without heſitation for any tendinous expanſion, though it ſignifies properly a nervous expanſion. Galen has even made uſe of this term to expreſs all ſorts of connections; and when he ſpeaks of that of the diaphragm to the ribs, he employs the verb from whence it is derived; ſo that if we were at liberty to coin a new Engliſh word, we might in his manner ſay, that the diaphragm ſymphyſed to the ribs.

Uſe of the bones in general.

160. The bones are in general in reſpect to the body, what a wooden frame is in reſpect to the whole building. They give ſtrength and poſture to the body, ſuſtain all its organs, and keep the animal in all ſituations proper for its functions, by means of their different conformation, ſtructure, and connection.

161. The apophyſes and epiphyſes dilate the ends of bones, and thereby increaſe the extent of the articulated parts. They make more room for the inſertion of muſcles and ligaments; they change the direction, and laſtly facilitate the action of many muſcles.

162. The external cavities receive the muſcles, direct the tendons, give paſſage to the blood veſſels, nerves, and ligaments, as we ſhall ſhew particularly in deſcribing each bone.

163. The uſes of the internal ſtructure equally deſerve our attention. The long hollow bones are very compact in the middle, and thereby ſecured againſt bending or breaking in great motions, and the ſtrokes to which they are expoſed. Their hollowneſs, joined to the ſolidity of their ſubſtance, increaſes theſe advantages; and, without augmenting their weight or quantity of matter, enables them to bear very great loads.

164 The cellulous ſubſtance in the extremities of theſe bones, and through the whole extent of almoſt all the reſt which are not liable to the ſame dangers, gives them a large ſize, with a ſmall portion of ſubſtance; and thereby pro-

cures for them a ſufficient extent, without any ſuperfluous incumbrance of weight.

165. The reticular ſubſtance ſuſtains the body of marrow with which the great cavities are filled, and the cells of the ſpungy ſubſtance ſerve to contain the ſeparate portions of medullary juice, as ſhall be ſhewn in the hiſtory of freſh bones.

166. It is ſufficient to obſerve about the articulations in general, that the moveable ones ſerve for all the motions and changes of ſituation of the whole body, or of its particular parts. Thoſe that are immoveable have the ſame uſes which carpenters or joiners find in making their works of many pieces, when they are to be much expoſed to external accidents.

167. Laſtly, the connection or ſymphyſis of bones ſupports them in their natural ſtate, whether they be deſigned for motion or not. I ſhall ſpeak to all theſe uſes at more length in the hiſtory of each bone, obſerving nearly the ſame order in which I have here mentioned them.

ART. II.

The bones of the head.

§ 1. *The bones of the head in general.*

168. THE head is compoſed of ſeveral bony pieces, one part of which by their connections form a kind of oval cavity properly called the *ſcull.* The other repreſents a complicated piece of ſculpture, which partly ſupports the anterior half of the ſcull; and as it forms the greateſt part of the face, it is called by that name.

169. Before we examine particularly each bone of the head, it is neceſſary, in order to prevent repetitions and obſcurity, to conſider the head in general, that is, as conſiſting of all the bones that belong to it. In this view ſeveral eminences, cavities, &c. come to be taken notice of, the formation of which is owing to more bones than one; and conſequently, in examining each bone by itſelf, we can ſee but an imperfect portion of them.

170. In the language of anatomiſts theſe parts may be called common, and thoſe that belong to ſome one bone only

ly may be termed proper. The common parts ought firſt to be diſtinctly known, before we go on to the proper ones; if we would ſhun an inconveniency otherwiſe inevitable, of explaining one unknown thing by another equally unknown.

171. The bony head being conſidered as one piece, the following particulars may be taken notice of in it: 1. Its ſituation in general; 2. The ſize; 3. The figure; 4. The external parts; 5. The internal ſtructure; 6. The ſituation in particular; 7. The connection; 8. The uſes. I ſhall follow the ſame order nearly, through the whole of this expoſition.

Situation in general.

172. The head is the higheſt or moſt ſuperior part of the whole ſkeleton.

Figure.

173. The whole head of the ſkeleton is ſpheroidal, compoſed, as it were, of two ovals, a little depreſſed on each ſide. One of them is ſuperior, the extremities pointing forward and backward; the other is anterior, the extremities being turned upward and downward in ſuch a manner, as that one extremity of each oval meets and is loſt in the other, at the place particularly known by the name of the forehead.

174. This complex figure being viewed ſideways repreſents a ſpheroidal triangle; and we ought further to obſerve about it, that the oval of the ſcull is broader behind than before, and that of the face broader above than below.

Regions.

175. The upper region is termed the *crown of the head*, the lower, the *baſis*; the lateral regions the *temples*; the anterior, the *forehead*; the poſterior, the *occiput*; the lower part of which is called the *nape of the neck.*

Eminences, cavities, inequalities.

176. Some of the eminences, cavities, and inequalities are external, being viſible in an entire head; others are internal, and can only be diſcovered by opening the ſcull. Both theſe kinds are either proper, belonging only to ſome one piece; or common to more pieces than one.

External eminences.

177. The external eminences are ten in number; two maſtoide, two ſtyloide, two condyloide, two pterygoide, and two arches, called *zygomata*. Of theſe five pairs, the three firſt are ſimple or proper; the other two, *viz.* the zygomata and pterygoides, are compound or common, being formed by the connection of

more bones than one; the zygomata by the Oſſa Temporum, and Oſſa Malarum: the pterygoide eminences by the Os Sphenoides and Oſſa Palati. To theſe may be added the tubercle and external ſpine of the occiput, and the condyloide and coronoide apophyſes of the lower jaw.

Simple external cavities.

178. The ſimple external cavities are, the parietal holes; the ſuperciliary holes, in place of which there are ſometimes only notches; the ſuperior orbitary ſlits; the optic holes; the external, or rather inferior orbitary holes; the holes in the Oſſa Naſi; the holes in the Oſſa Malarum; the maxillary foſſæ; the oval holes in the baſis of the ſcull; the ſpinal holes; the orifices of the paſſages of the internal carotides; the maſtoide grooves; the ſtylomaſtoide holes; the poſterior maſtoide holes; the large occipital hole; the anterior and poſterior condyloide holes; the glenoide cavity and fiſſure for the articulation of the lower jaw; the external auditory hole; the ſmall poſterior maxillary holes; the ſockets in both jaws; the internal and external orifices of the canal of the lower jaw, which laſt may likewiſe be named the *holes of the chin.*

Compound external cavities.

179. The compound external cavities are the orbits, the edges of which are divided into two lateral parts, improperly called *angles*, one internal toward the noſe, the other external toward the temples; the temporal foſſæ: the zygomatic and naſal cavities, which laſt are alſo called *noſtrils*; which have anterior and poſterior openings, and are parted by a middle ſeptum; the vault of the palate; the anterior hole of the palate, or of the inciſors; the poſterior holes of the palate; the pterygoide foſſæ; the inferior orbitary, or ſpheno-maxillary ſlits; the interior orbitary holes, one anterior, and one poſterior; the naſal or lachrymal duct; the duct of Euſtachius, called the *aqueduct*, the ſmall foſſæ for the internal jugular veins; and the foramina ſpheno-palatina and lacera.

Internal eminences.

180. The internal eminences are the frontal or coronal ſpine; criſta galli; the cella turcica, or ſphenoidalis; the clinoide apophyſes, apophyſes petroſæ; the internal occipital ſpine; the crucial tubercle, and two lateral criſtæ.

Internal cavities.

181. Of the internal cavities, one is ſimple, the bottom of the ſella ſphenoidalis, called *foſſa pituitaria.*

pituitaria. The reſt are compound, viz. eight large foſſæ in the baſis of the ſcull, two anterior, two middle; and on the backſide two upper, and two lower; the grooves of the ſuperior longitudinal and of the lateral ſinuſſes, and the ſulci of the arteries of the dura mater.

External inequalities.

182. The external inequalities are two large ſemicircular planes ſurrounding the temples, one on each ſide; the edge or circumference of which begins by a ſort of criſta or ſpine above the external angle of the orbit, and ends in two arches, one on the foreſide, the other on the backſide of the maſtoide proceſs; two occipital arches, one ſuperior, the other inferior, which are both divided into two portions by the occipital criſta or ſpine; the external veſtiges of the ſutures, &c.

Internal inequalities.

183. The internal inequalities are the undulated impreſſions in the baſis of the ſcull; the internal veſtiges of the ſutures, &c.

Subſtance.

184. The compact or ſolid ſubſtance of the bones of the ſcull, is called *table*, of which one is external, and another internal, called alſo the *vitrious table*, as being more brittle than the former, becauſe it is of a more cloſe texture.

185. The ſpungy or cellulous ſubſtance between the two tables, is named *diploë*, the quantity of which is proportionable to the thickneſs of the bones. In ſome places it is wanting, and there the tables uniting, are ſomething tranſparent, as in the temporal bones, &c. In the internal table there are ſeveral conſiderable depreſſions, ſome of them near a quarter of an inch in depth, which run in through the diploë, and even reach the outer table. Theſe depreſſions deſerve to be taken notice of in relation to the operation of trepanning.

Situation in particular.

186. By the ſituation of the head in particular, I underſtand the natural poſture of it, when a man ſtands, or ſits, without inclining his head either backwards or forwards, to one ſide or the other, or drawing it down upon the neck or ſhoulders. Particular regard ought to be had to this ſituation in examining the head, either in general or in particular; and eſpecially in conſidering the lower parts of the baſis of the ſcull, and arch of the palate.

187. The common method of ſhewing theſe parts in a ſcull turned upſide down, has often occaſioned even expert anatomiſts to miſtake the upper parts for the lower, and the lower for the upper. Therefore it is very neceſſary for beginners often to hold the ſkeleton of a head raiſed, in its true poſture, and to view it from below upwards, that they may frame to themſelves a juſt idea of it.

188. In order to this, whether the head be held in our hands, or ſet upon any thing elſe, the beſt way I have as yet hit upon, is to place the two zygomatic arches in a plane exactly parallel to the horizon. An head divided into two equal lateral parts, is likewiſe of great uſe in determining the true ſituation of the parts I have mentioned, and of thoſe that lie near them.

Connection. 189. The connection of the head with the trunk is by ginglymus; the condyloide proceſſes of the Os Occipitis, being received in the ſuperior cavities of the firſt vertebræ of the neck. The connection of the particular bones of the head with each other is partly by diarthroſis, as in the articulation of the lower jaw; partly by ſynarthroſis, which obtains in the articulation of all the other bones, as ſhall be ſhewn hereafter.

Uſes. 190. The principal uſes of the bones of the head are to contain the brain, to be the ſeat of the organs of ſenſation, and to ſerve for maſtication, reſpiration, the voice, &c.

§ 2. *The bones of the ſcull in particular, and firſt, the Os Frontis.*

191. The eight principal bones of the ſcull are ordinarily divided into common and proper. By proper bones, anatomiſts mean thoſe which are wholly employed in forming the globe of the ſcull; and of theſe they reckon ſix, the Os Frontis, two Parietal Bones, the Occipital Bone, and two Oſſa Temporum. The common bones are thoſe which contribute to form the face as well as the ſcull, *viz.* the Os Ethmoides, and Os Sphenoides.

192. This diviſion is not juſt; for the Os Frontis and Oſſa Temporum deſerve as much to be called common, as the two that are reckoned ſuch; and thus, inſtead of ſix, there

would be only three proper bones, the Oſſa Parietalia, and Os Occipitis; and inſtead of two there would be five common ones; the Os Frontis, two Oſſa Temporum, the Os Ethmoides, and Os Sphenoides.

Situation of the Os Frontis in general.

193. The Os Frontis is ſituated in the anterior part of the ſcull, and forms that part of the face which is called the *forehead,* from whence it has its name.

Figure.

194. Its figure is ſymmetrical, reſembling a large ſhell almoſt round; ſo that two frontal bones of the ſame ſize joined together, repreſent one ſort of ſhell fiſh pretty exactly.

Diviſion.

195. Before we ſpeak of the parts of this bone, we muſt take notice, that though it is always looked upon as one bone, it is ſometimes found to be divided into two equal parts, by a continuation of the ſagittal ſuture, and this diviſion is common to both ſexes equally.

Regions.

196. When we conſider it as one bone, it may be divided into an upper part, which belongs to the crown of the head; a lower part which belongs to the baſis of the ſcull; an anterior part, which is the forehead; and two lateral parts, at which the temples begin.

197. It has two ſides, one external, which forms the forehead, the greateſt part of it being convex; and one internal, which is concave in proportion. By external I here mean what appears when the ſcull is entire; and by internal, what cannot be ſeen till the ſcull is opened.

External eminences.

198. On the outſide we obſerve the following eminences; two ſuperciliary arches, which form the upper edge of each orbit, or the ſupercilia; three riſings not always equally apparent, one between the two arches, aad the other two above the arches, which may be called the *knobs* of the forehead; five apophyſes, one at the extremities of each arch; one between the orbits which ſuſtain the Oſſa Naſi, and which in ſome ſubjects makes a part of the bony ſeptum of the noſe. This laſt I call the *naſal apophyſis*, and the other four the *angular apophyſes*.

External cavities.

199. The external cavities are theſe; two orbitary arches or vaults, forming the upper portions of the orbits; a remarkable depreſſion in each of theſe vaults, above the external angle, which contains

the lachrymal gland : a ſmall depreſſion above the internal angle, to which is fixed the cartilaginous pully of the great oblique muſcle of the eye ; two portions of the temporal foſſæ ; two little criſtæ, which form the anterior extremity of the great ſemicircular plane of the temples on each ſide, at the edge of the ſuperciliary arches, near the external angle ; two ſuperciliary foramina, which are ſometimes double, and ſometimes only notches ; and laſtly, two holes or portions of holes, called the *internal orbitary holes*.

Internal eminences and cavities.

200. On the inſide of this bone we ſee a ſharp perpendicular eminence, called the *frontal*, or *coronal ſpine*, directly oppoſite to the middle riſing on the outſide already mentioned ; above this ſpine a portion of the groove for the longitudinal ſinus, which, when the ſpine is wanting, runs down lower ; below the ſpine, a conſiderable opening, called the *ethmoidal opening*, becauſe it contains the Os Ethmoides, the ſides thereof are always more or leſs cellulous, Between this opening and the coronal ſpine, a blind hole which in ſome ſubjects is wholly in the Os Frontis, in others, common to that bone, and to the Os Ethmoides, and which ſeems to open into the frontal ſinuſſes near the noſe : the anterior foſſæ of the baſis of the ſcull, which receive the anterior lobes of the brain ; and which, by jutting out forwards, form the riſings on the outſide already taken notice of ; towards the lower part, they are uneven, anſwering the inequalities of the lobes, and they are alſo a little raiſed to make room for the orbits : ſulci or furrows for the arteries of the dura mater, and ſometimes indeterminate depreſſions, mentioned N° 181. in the general account of the head.

Subſtance and ſinuſſes.

201. This bone is compoſed, as has been already obſerved in general, of two tables and a diploë, except the orbitary vaults, which are very thin, and without any diploë. About the middle of the lower part of the bone, where the middle riſing is commonly ſituated, the two tables are parted, to form two cavities, called the *frontal*, or *ſuperciliary ſinuſſes* ; and the ſeparated portions are each of them in ſome meaſure compoſed of two tables, or at leaſt have two ſurfaces, which makes in all four ſurfaces or tables.

202. The frontal ſinuſſes are extended on the edge of the

ſupercilia, on each ſide more or leſs, all the way to the ſuperciliary perforations: below, they are open, and communicate with the cells of the Os Cribroſum. They are commonly parted by a bony ſeptum, which is often more to one ſide than to the other, and more or leſs uneven. Sometimes it is perforated; and ſometimes part of it, and ſometimes the whole is wanting.

203. In different ſubjects, theſe ſinuſſes are obſerved to vary extremely, both in reſpect of their extent, which in ſome is very ſmall, and in reſpect of their form which is often very irregular, and their diſpoſition cellulous. Sometimes they are entirely wanting, and in ſuch ſubjects the internal cavity of the noſe is larger than ordinary. It has likewiſe been remarked, that one of them does not open into the noſe, but only communicates with the other.

Situation in particular.

204. To have a juſt idea of the true ſituation of all the parts of this bone, we ought, in examining or demonſtrating it, to hold it in the ſame manner as it is ſituated in an entire head, placed as has been already directed, No 188. For thus, we ſhall ſee that the upper part of it is a little inclined backward, and that its circumference or edges are in an inclined plane.

Connection.

205. The Os Frontis is articulated by ſuture, with ſeven other bones; the Oſſa Parietalia, Os Ethmoides, Os Sphenoides, Oſſa Lachrymalia, Oſſa Naſi, Oſſa Maxillaria, and Oſſa Malarum.

Uſes.

206. It contains the anterior lobes of the brain, and a portion of the longitudinal ſinus. It forms the forehead, the upper part of the orbits, and a portion of the temples.

§ 3. *Oſſa Parietalia.*

207. The parietal bones are two in number, one on each ſide, ſituated on the ſuperior, lateral, and a little on the poſterior parts of the ſkull.

Size and figure.

208. They are of a larger extent than any other bone of the ſcull; their figure is nearly that of an irregular convex ſquare.

Parts.

209. They have each two ſides, one external and convex, the other internal and concave; four edges, one ſu-

ſuperior or ſagittal, one inferior or temporal, one anterior or frontal, and one poſterior or occipital. The ſuperior edge is the longeſt, the inferior the ſhorteſt, in which there is a very large ſquammous ſlope, which I name the *temporal ſlope.* The upper and poſterior edges are indented through their whole length. The anterior edge is likewiſe indented, except at the lower part; all the lower edge is ſquammous, except a ſmall part next the Os Occipitis.

210. It has four angles, the anterior and upper, the anterior and lower; the poſterior and upper, the poſterior and lower. The anterior and lower angle ends in a ſqammous production, which, from its ſituation, I call the *temporal angle,* or apophyſis.

211. On the outſide, above the temporal ſlope, we ſee the moſt conſiderable portion of the ſemicircular plane of the temporal muſcle. Near the upper edge, towards the poſterior angle, is a ſmall hole called the *parietal hole,* which is ſometimes found only in one of the bones, ſometimes in the ſagittal ſuture, and ſometimes it is wanting. In ſome bones, it goes only to the diploë; in others, it perforates both tables.

212. The inſide is ſomething uneven, and many furrows are remarkable upon it, anſwering to the ramifications of the artery of the dura mater; the trunk of which is lodged ſometimes in a groove, ſometimes in a very ſhort perfect canal, running through the ſubſtance of the bone near the anterior and lower angle. Near that, another ſuch canal is ſometimes, though rarely, met with, for another artery of the dura mater.

213. Along the upper edge of this inſide, we ſee one half of the ſagittal groove for the longitudinal ſinus; and at the poſterior and lower angle we meet generally with a ſmall portion of another groove for the lateral ſinus. Laſtly, the ſame ſort of irregular indeterminate depreſſions are ſometimes obſervable in this bone, which we took notice of in the Os Frontis.

Subſtance.

214. Theſe bones are the weakeſt of the eight that compoſe the ſcull. The diploë is found between the tables, through the whole length of the ſagittal and occipital edges, and through the upper half of the coronal edge.

Situation in particular.

215. To place or demonſtrate this bone in its true ſituation, we need only obſerve what has been ſaid concerning its edges and angles, No. 209. 210. remember-

ing only that the poſterior and lower angle reaches farther down than the anterior.

216. Each parietal bone is joined to that on the other ſide, by the ſagittal ſuture; to the Os Frontis, by the coronal ſuture; to the Os Occipitis, by the lamboidal ſuture; and to the Oſſa Temporum and Os Sphenoides, by the ſquammous ſuture. *Connection.*

217. Its connection with the Os Frontis, below the ſemicircular plane, is by the ſquammous ſuture, and the ſame is to be ſaid of its articulation with the ſphenoidal bone, as well as with the Oſſa Temporum. The ſquammous portions of the Os Frontis are covered by thoſe of the Oſſa Parietalia; the ſquammous ſlopes in theſe laſt are covered by the Oſſa Temporum; and the ſquammous apophyſis of the Oſſa Temporum is covered by a proceſs of the Os Sphenoides.

218. Theſe bones contain a large portion of the brain, form part of the temples, ſerve for the inſertion of the temporal muſcles, *&c.* *Uſes.*

§ 4. *Os Occipitis.*

219. The occipital bone is ſituated in the poſterior and lower part of the cranium. *Situation in general.*

220. It repreſents a kind of lozenge irregularly indented, and yet ſymmetrical, convex on the outſide and concave on the other. It conſiſts very rarely of two pieces divided by the continuation of the ſagittal ſuture. *Figure.*

221. It conſiſts of an external and internal ſide; of the upper, lower, lateral, and middle parts (the firſt four of which may be looked upon as ſo many angles) of four edges, two ſuperior which are indented, and two inferior, which are more or leſs unequal. *Diviſion.*

222. The outſide is convex, near the middle of which the occipital protuberance or riſing is obſervable. Under this protuberance are two ſuperficial tranſverſe arches, more remarkable in ſome ſubjects than in others; one ſuperior and largeſt, the other inferior and leaſt, and both reaching to the maſtoide proceſs on each ſide. The inferior arch is cut at right angles by a perpendicular line called the *external occipital ſpine*, or *criſta*. Under the ſuperior arch are two rough planes, one on each ſide of the ſpine; and between the ex-

tremities of the two arches, are two other ſuch planes, one on the right hand, the other on the left. We ſee likewiſe two condyles or condyloide apophyſes cruſted over with cartilages, gently convex, of an oblong oval figure, and ſituated obliquely, their poſterior extremities being at a greater diſtance from each other than the anterior: alſo a large cuneiform production, which, from the condyles, is directed upwards, and in adults is often joined inſeparably to the Os Sphenoides; it may be termed *apophyſis baſilaris*, or the great apophyſis of the occipital bone. Laſtly, ſome unequal tubercles on the lower part of this apophyſis, and two little angular productions in the edge of the bone over againſt the condyles.

223. We are likewiſe to take notice of two large notches under the lateral angles, which receive the poſterior apophyſes of the Oſſa Temporum, two ſmall notches or portions of the jugular foſſæ, and of the foramina lacera; each of which is often divided by a ſmall bony production: the great occipital hole, on the interior edge of which there is an impreſſion for the inſertion of a ligament: two anterior and two poſterior condyloide foſſulæ: two anterior condyloide holes for the ninth pair of nerves, which are ſometimes double: two poſterior condyloide holes for ſmall veins, which are ſometimes wanting.

224. The inſide of this bone is concave, and there we are to take notice of a crucial groove, the edges of which are a little raiſed; the upper branch contains part of the great longitudinal ſinus of the dura mater, the lateral branches receive the lateral ſinuſſes, and the lower branch is oftener a ſpine or criſta, than a groove: it is ſituated oppoſite to the external ſpine, and may be called the *internal occipital ſpine*. It happens often that the groove for the longitudinal ſinus is more to one ſide than to the other. We ſee alſo the place where theſe grooves croſs each other: a conſiderable tubercle oppoſite to the external protuberance: four foſſæ ſeparated by the four branches of the crucial groove, two of which contain the poſterior lobes of the brain, and the other two, the cerebellum: a very broad groove in the apophyſis cuneiformis, for the medulla oblongata, *&c.* two ſmall portions of grooves lower down, which complete the grooves for the lateral ſinuſſes of the dura mater. Along the inner edge of

the large occipital hole, there is a kind of groove more or leſs ſenſible.

Subſtance.

225. The upper part of this bone is very thick, as being much expoſed to blows; the lower part of it is thin, but well guarded by muſcles. The thickeſt part of the whole bone is at the occipital protuberance, between which and the tubercle of the crucial groove, there is a large quantity of diploë.

Situation in particular.

226. To ſet the occipital bone in its true ſituation, the great foramen is to be turned downward, and placed horizontally; the apophyſis cuneiformis, forward and a little raiſed.

Connection.

227. This bone is joined on the upper part, to the Oſſa Parietalia, by the lambdoidal ſuture, on the lower and lateral parts, to the Oſſa Temporum by the continuation of the lambdoidal ſuture; on the lower and anterior part, to the Os Sphenoides, by the apophyſis cunieformis, both which in adults make commonly but one bone. It is likewiſe joined by a kind of ſuture to the ſupernumerary bones, when there are any ſuch.

Uſes.

228. The Os Occipitis forms the back part of the head; ſerves for the articulation of the head with the trunk; contains a part of the brain, and almoſt all the cerebellum; gives paſſage to the medulla oblongata, and to a great many veſſels and nerves; gives inſertion to a great many muſcles, *&c.*

§ 5. *Os Sphenoides.*

Situation in general.

229. The ſphenoidal bone is ſituated in the lower part of the cranium, a little toward the fore-part, making the middle of the baſis of the ſcull, from whence it got the name of *Os Baſilare.* It is called *ſphenoides* or *cuneiforme*, becauſe it is in a manner wedged in between the other bones.

Figure.

230. It is of a very odd figure, and yet ſymmetrical. Its greateſt extent is tranſverſe, and it may in ſome meaſure be ſaid to repreſent a bat, with its wings ſpread.

Diviſion.

231. It conſiſts of a great number of parts. The poſterior and thickeſt part, by which it is joined to the apophyſis of the Os Occipitis, may be called its body.

The reſt is wholly made up of eminences and cavities; and in order to examine theſe methodically, the bones muſt firſt be divided into two ſides, one external, the greateſt part of which may be ſeen in an entire ſcull; the other internal, which does not appear till the ſcull is opened.

Eminences on the outſide.

233. The eminences on the outſide are theſe: two temporal apophyſes, which are the largeſt of all the proceſſes of this bone, and at the greateſt diſtance from each other; called by Ingraſſias the great wings of the Os Sphenoides, and they are ſometimes, though very rarely, ſeparated from the reſt of the bone by tranſverſe ſutures: two orbitary apophyſes, which form a conſiderable portion of the orbit, next the temples: a ſmall ſharp proceſs ſhaped like a bird's bill, in the middle ſpace between the two orbitary apophyſes: two pterygoide apophyſes, each of which is divided into two alæ, one external, which is the largeſt, the other internal, the lower end of which is in the ſhape of a hook. Each ala is again divided into two ſides, one external, towards the temples, and one internal, towards the palate: two ſpinal apophyſes, a little anterior eminence above the ſharp proceſs, for the articulation of this bone with the Os Ethmoides. In ſome ſubjects, inſtead of this eminence there is a little notch.

Cavities on the outſide.

233. The external cavities are as follow: two portions of the temporal foſſæ: two portions of the orbitary foſſæ: two pterygoide foſſæ, the lower ends of which are divided by an irregular notch or ſlit, which may be termed *fiſſura palatina*: a little oblong foſſula at the root of the internal ala: two ſuperior orbitary or ſphenoidal fiſſures: a little notch at the end of each fiſſure, for the paſſage of an artery of the dura mater; two temporal notches: two maxillary notches, the edges of which help to form the inferior orbitary fiſſures, which I call *fiſſuræ ſphenomaxillares*; theſe edges are likewiſe ſometimes conſiderably grooved: two holes for the ſuperior maxillary nerves: two other holes on one ſide of the former, called *pterygoide*, which in an entire ſcull are hid by other bones: two oval holes for the inferior maxillary nerves: two little round holes, called *ſpinal holes*, each of which tranſmits an artery of the dura mater; ſometimes they are only notches: another little hole between the two maxillary holes; a little groove on one ſide

of the ſpinal apophyſis, which forms part of the Euſtachian tube.

234. The internal eminences are two thin ſharp tranſverſe apophyſes, which form the ſuperior orbitary fiſſures, called by Ingraſſias the little wings of the ſphenoidal bone; a little proceſs in ſome ſubjects in the middle ſpace, between theſe thin apophyſes, for the articulation with the Os Ethmoides, which in other ſubjects is a notch: four clynoide apophyſes, two anterior, and two poſterior; which laſt are ſometimes united in one, and ſometimes they run forward all the way to the anterior proceſſes, forming a kind of bridge, under which the internal carotide artery paſſes at its laſt curvature; this paſſage has likewiſe been found divided in two by a middle bony ſeptum, beſides many other varieties: one or two ſmall productions, where the internal carotide enters the cranium: two little ſtyloide proceſſes or hooks, which in ſome ſubjects join the extremity of the Os Occipitis, before the perfect union of theſe two bones.

Eminences on the inſide.

235. The internal cavities are: two portions of the large middle foſſæ of the baſis cranii; two ſuperior orbitary or ſphenoidal fiſſures: two optic holes: a ſmall ſuperior orbitary hole, near the end of each ſphenoidal fiſſure, which is often no more than a notch: a ſmall groove at the extremities of the ſame fiſſures: a depreſſion between the clynoide apophyſes, called *ſella ſphenoidalis*, *ſella turcica*, and *foſſa pituitaria*. We ſee likewiſe almoſt all the holes taken notice of in the outſide, and in particular, that the ſuperior maxillary hole ought more juſtly to be called a *ſhort canal.*

Cavities on the inſide.

236. Beſides the cavities hitherto mentioned, there are two very conſiderable ones, called the *ſphenoidal ſinuſſes*, ſituated in the thick portion of this bone, under the anterior part of the ſella turcica and middle ſpace, between the two optic holes, reaching as far as the ſharp proceſs or bill already deſcribed; they are commonly divided by a bony ſeptum, and they open before, on each ſide of the ſharp proceſs, juſt behind the ſuperior conchæ of the noſe or Oſſa Convoluta ſuperiora. Their figure, ſize, openings, and ſeptum, vary conſiderably; ſometimes one of them is wanting, ſometimes one opens only into the other; ſometimes they are both

wanting; ſometimes there are ſeveral cells without any ſeptum, and ſometimes the ſeptum is placed more to one ſide than to the other.

Subſtance. 237. The ſubſtance of this bone is compact for the greateſt part, having very little diploë, and what diploë there is, lies in diſtinct parts of the bone, *viz.* in the thick portion behind the ſella turcica towards the ſymphyſis with the occipital bone, and in the orbitary apophyſes in a ſmall quantity.

Situation in particular. 238. To ſituate the ſphenoidal bone aright, the ſella turcica muſt be turned upward, the ſharp proceſs forward, and the pterygoide apophyſes downward.

Connection. 239. It is articulated with all the other bones of the cranium, with the Oſſa Malarum, Oſſa Maxillaria, Oſſa Palati, and Vomer.

Uſes. 240. The uſes have all been mentioned in the courſe of the deſcription.

§ 6. *Os Ethmoides.*

Situation in general. **241.** The Os Ethmoides is ſituated interiorly in the fore-part of the baſis cranii.

Figure. 242. The figure of the whole bone taken together is very particular; it may be ſaid, however, in ſome meaſure to be cubical.

Diviſion. 253. The diviſions of this bone are perfectly arbitrary; that which I make choice of is into a middle and two lateral portions; in the middle portion I diſtinguiſh three parts, an upper, middle, and lower.

244. The upper part of the middle portion is an eminence, called *criſta galli*, which is often ſolid; ſometimes, however, it has been found hollow in ſeveral degrees, and perforated by a ſmall opening, which communicates with the frontal ſinuſſes: a groove is ſometimes met with in its anterior edge, which leads to the ſpinal or blind hole in the Os Frontis.

245. The middle part of this portion is a ſmall horizontal plate perforated by ſeveral holes, called *lamina cribroſa*, and in the back-part it has a little notch for its articulation with the ſphenoidal bone. This lamina may be reckoned the body

dy of the bone, as being what principally ſupports all the other parts thereof.

246. The lower part is a perpendicular lamina, which makes part of the ſeptum narium. Its edge is rough and uneven for its better connection with the vomer.

247. The lateral portions of the ethmoidal bone are by far the moſt conſiderable, if we regard the ſize only. I divide each of them in two, one ſuperior, which is the largeſt, and which I term the labyrinth of the noſtrils, it being full of turnings and windings, and irregularly cellulous; and one inferior in the ſhape of a ſhell.

248. The labyrinth has four ſides and two ends. The upper ſide is partly covered by the cells of the frontal ſinus, and large opening already deſcribed. The lower ſide is partly joined to the cells of the Os Maxillare, and partly left expoſed and free; it ſends backward ſeveral productions more or leſs conſiderable, which in ſkeletons are often broken. Theſe productions ſometimes join the root of the ſharp proceſs in the ſphenoidal bone, being there fixed in lateral grooves. The inſide is ſomething convex and rough; it is turned toward the ſeptum, and fixed only to the edge of the lamina cribroſa. The outſide is flattened and very ſmooth, from whence it got the name of *Os Planum*; it makes part of the inſide of the orbit, and at its upper edge there are often one or two ſmall notches, parts of the internal orbitary holes already mentioned in the deſcription of the Os Frontis.

249. The anterior extremity of the labyrinth is unequally cellulous; it is partly covered by the cellulæ in the large opening of the Os Frontis, and partly by the Os Unguis; and by a kind of funnel it communicates with the frontal ſinus. The poſterior extremity is covered partly by the ſphenoidal bone, and partly by the Os Palati.

250. The inferior part of each lateral portion reſembles in ſome meaſure an oblong ſhell, ſuch as that of a muſcle. I give it the name of *concha narium ſuperior*, or upper ſhell of the noſtrils. It is very rough and porous, its convex ſide being towards the ſeptum, and the concave ſide towards the Os Maxillare. One end of it is turned backward, the other forward, and there the upper part of it joins the labyrinth, by means of the funnel already mentioned. This inferior

part is diſtinguiſhed from the ſuperior or labyrinth, by a remarkable lateral groove.

Situation in particular. 251. What has been ſaid is ſufficient to direct us in ſituating this bone, remembering only that the head of the criſta galli ought to be turned forward.

Subſtance. 251. It is of a very delicate and tender ſtructure, though compact and without any diploë, being almoſt all compoſed of very thin bony plates.

Connection. 253. It is joined to the Os Frontis, Os Sphenoides, Oſſa Naſi, Oſſa Maxillaria, Oſſa Unguis, Oſſa Palati, and Vomer.

Uſes. 254. The uſes of it are to be a principal part of the organ of ſmell, and to give a very great extent to the pituitary membrane in a ſmall compaſs, &c.

§ 7. *Oſſa Temporum.*

Number and ſituation in general. 255. The Oſſa Temporum are two in number, ſituated in the lower and lateral parts of the ſcull.

Figure. 256. The figure of each is partly ſemicircular, reſembling the ſcale of a fiſh, partly like a ſhapeleſs rock ending in ſeveral points.

Diviſion. 257. Each of them is divided into two portions, one ſuperior termed *ſquammous* from its figure; the other inferior, called *apophyſis petroſa*, or the *rock*, not ſo much from its figure as from its hardneſs. This portion is eaſily ſeparable from the former in children, and ſome marks of this diviſion ſtill remain in adults, as Riolan has obſerved.

258. They are likewiſe divided into two ſides, one external and convex, the other internal and concave; and thus the eminences and cavities in them may likewiſe be divided into external and internal.

External eminences. 259. The external eminences are the maſtoide apophyſis in the lower and poſterior part of the bone: the zygomatic apophyſis in the anterior part: the ſtyloide apophyſis under the bone, which ſeems originally to have been an epiphyſis. In one ſubject I ſaw this apophyſis three inches in length; and in another, a ſtyloide appendix joined to the ordinary apophyſis by a ligament, and ſtretched along the ſtylo-pharingæus muſcle: the capſular apophyſis in which the bony ſtilet ſeems as it were to be ſet: the articular eminence of the zygomatic apophyſis: the lambdoidal angle; the lower ſide of the apophyſis petroſa.

External cavities.

260. The external cavities are the articular cavity immediately behind the eminence ſo called, which both together ſerve for the articulation of the lower jaw; the crack in the articular cavities: the maſtoide notch or groove in which the digaſtric muſcle is inſerted: the opening of the external meatus auditorius; the anterior indented border of that opening: the ſtylo-maſtoide or anterior maſtoide hole, which is the orifice of the paſſage of the portio dura of the auditory nerve: Fallopius termed this paſſage the aqueduct, not becauſe of its uſe, but becauſe of the reſemblance it bears to a kind of aqueduct in his country: the orifice or inferior hole of the carotide canal in the apophyſis petroſa, which alters its direction upward and forward, and ends at the point of the rock near the ſella ſphenoidalis: a portion of the jugular foſſa, and a portion of the foramen lacerum.

261. Among the external cavities, we are likewiſe to reckon a portion of the ductus palatinus of the ear, called commonly *tuba Euſtachiana*, and in France the *aqueduct*. This duct, which muſt not be confounded with the aqueduct of Fallopius, follows pretty much the direction of the articular crack: the zygomatic notch: the parietal notch, which receives the poſterior and lower angle of the Os Parietale: the ſphenoidal notch, which receives the ſpinal apophyſis of the Os Sphenoides; one or more little ſulci for the ramifications of the temporal artery; the groove in the apophyſis petroſa, by which it is connected to the great apophyſis of the Os Occipitis. We may likewiſe add the poſterior maſtoide hole, through which a ſmall vein paſſes, that empties itſelf into the lateral ſinus: this hole is ſometimes formed between this bone and the Os Occipitis, ſometimes it is wanting in one of the bones, and ſometimes in both, There is likewiſe in ſome ſubjects, a ſmall ſuperior maſtoide hole, which loſes itſelf in the ſubſtance of the bone.

Internal eminences and cavities.

262. In examining the internal eminences and cavities, we muſt diſtinguiſh the ſquammous portion from the apophyſis petroſa. In the former

we ſee the radiated indentations of the ſemicircular edge, which, with the parietal bone, forms the ſquammous ſuture; a portion of the middle foſſa of the baſis cranii on the ſame ſide, and ſeveral inequalities in that foſſa.

263. The apophyſis petroſa or rock, is a ſort of pyramidal body with three ſides ſituated obliquely, ſo as that its baſis is turned backward and outward, and its apex forward and inward towards the ſella turcica. Of the three, ſides one is ſuperior and inclined a little forward; the ſecond poſterior, and the third inferior: this laſt belongs to the outſide of the whole bone, which has been already deſcribed.

264. The upper ſide aſſiſts in forming the middle foſſa of the baſis cranii, being uneven in the ſame manner as the inſide of the ſquammous portion. We obſerve here a ſmall irregular hole appearing to be double, and partly covered by a ſmall bony plate. This hole is a kind of break or interruption in the duct, through which the portio dura of the auditory nerve paſſes.

265. In the backſide of the rock we ſee the internal auditory hole, and a portion of the foſſa for the cerebellum. Sometimes ſmall indeterminate depreſſions are obſervable in it, pretty deep in children, but gradually obliterated as they advance in years. At the baſis of this apophyſis we ſee a portion of the groove for the lateral ſinus, formed partly in this baſis, and partly in the lambdoidal angle; alſo a portion of the foramen lacerum; and a ſmall point, which, as it were, divides this hole in two, and diſtinguiſhes the paſſage of the jugular vein, from that of the eight pair of nerves.

266. As this apophyſis has three ſides, ſo we may obſerve in it three angles; the firſt ſuperior between the upper and back ſides; the ſecond poſterior, between the back and lower ſides; and the third anterior, between the lower and fore ſide. The ſuperior angle, which is the moſt apparent, has a groove for a ſmall ſinus of the dura mater; the poſterior angle is in a manner interrupted near the middle by the foramen lacerum, and from it proceeds the little bony point which divides this hole. At the end of it is a groove, by which it is connected with the great apophyſis of the Os Occipitis. Between the apex of the apophyſis petroſa and the ſuperior opening of the carotide canal, we often meet with

a ſmall bone of the ſeſamoidal kind, mentioned long ago by Riolan.

267. To ſet any one of the Oſſa Temporum in its true ſituation, the zygomatic apophyſis muſt be placed horizontally and turned forward, and the maſtoide proceſs directly downward. *Situation in particular.*

268. Almoſt the whole ſubſtance of the Oſſa Temporum is compact. The ſquammous portion is thin and tranſparent. The maſtoide apophyſis is hollowed by conſiderable cells. The ſubſtance of the apophyſis petroſa is very hard and ſolid, with ſeveral internal cavities for the organ of hearing contained in it. *Subſtance.*

269. Each Os Temporis is joined above, to the Os Parietale by a ſquammous ſuture, behind and below, to the Occipital bone, partly by a true ſuture, and partly by harmony; before to the great alæ of the Os Sphenoides, by a ſquammous ſuture, and below to the ſpinal apophyſes of that bone. It is likewiſe joined before, to the Os Malæ by the zygomatic ſuture. *Connection.*

370. The chief uſes of theſe bones are to complete the globe of the ſcull, to ſerve for the articulation of the lower jaw, and for the inſertion of many muſcles, and laſtly to contain the organ of hearing. *Uſes.*

N. B. The deſcription of the bones of the ear, and of the ſupernumerary bones of the ſcull, is placed immemediately after that of all the other bones of the head.

§ 8. *The bones of the face; and firſt, the Oſſa Maxillaria.*

271. I ſhall only add here, to what has been ſaid about theſe bones in general, in the enumeration of the parts of the ſkeleton, that the Oſſa Palati, Vomer, Conchæ Narium inferiores, and Oſſa Unguis, are very improperly ſaid to belong to the face, except we chuſe to look upon them as concerned in the internal ſtructure of the noſe, which is undoubtedly a part of the face.

272. The Oſſa Maxillaria, or great bones of the upper jaw, are two in number, ſituated one one each ſide, in the anterior and middle part of the face. *Number and ſituation of the Oſſa Maxillaria.*

Figure. 273. Their conformation is very irregular, and they are of a very conſiderable extent.

Diviſion. 274. Each of them may be divided into two ſides, one external, the other internal. By the external ſide, I mean all that appears in an entire ſcull, without taking in the arch of the palate; and by the internal ſide, that which makes part of the arch of the palate, and all that is turned to the ſeptum narium.

External eminences. 275. The external eminences are the naſal apophyſis, which makes the lateral part of the noſe; the orbitary apophyſis, which makes the inferior portion of the cavity of the orbit, and by a ſort of criſta forms the internal portion of its edge; this proceſs is likewiſe called *apophyſis malaris*, becauſe of its connection with the Os Malæ: the apophyſis palatina, which together with that on the other ſide, forms the arch of the palate; the apophyſis alveolaris, which is in the ſhape of an arch, and contains the teeth: the maxillary tubercle, or the poſterior extremity of the laſt named arch; the ſpine of the nares, which is a ſmall pointed eminence above the anterior extremity of the apophyſis alveolaris.

External cavities. 276. The external cavities are theſe: a portion of the orbitary foſſa, where there is a ſmall foſſula, in which the inferior oblique muſcle of the eye is inſerted, near the lachrymal duct, and a fiſſure or crack, of which hereafter: a portion of the zygomatic foſſa: a portion of the foſſa palatina, or arch of the palate, in which many little inequalities are obſervable, more or leſs pointed, and often little pointed hooks.

277. Alſo the lachrymal opening, which receives the Os Unguis: a ſmall lachrymal groove, which together with the Os Unguis forms the ſuperior part of the lachrymal duct; the opening of the nares; a portion of the inferior orbitary fiſſure, or fiſſura ſpheno-maxillaris; the opening which receives the Os Palati; a very ſmall notch at the anterior extremity of the arch of the palate, which forms the anterior foramen inciſorium, ſo called from its ſituation behind the inciſors; an oblique groove in the poſterior part of the maxillary tubercle, which contributes to the formation of the poſterior foramen maxillare.

278. Alſo the orbitary canal, which runs from before, back-

ward immediately under the inferior portion of the orbit; an anterior orbitary hole, or the anterior orifice of the orbitary canal: the poſterior orbitary hole, or the poſterior orifice of the orbitary canal, by which that canal ends at the edge of the ſpheno-maxillary fiſſure: the crack or fiſſure of the orbitary canal, which appears more or leſs in the orbit, and is often a little open backward: the ſmall holes of the maxillary tubercle. The ſmall holes near the orbitary canal and thoſe of the apophyſis naſalis vary and are ſometimes wanting. The ſockets ſhall be deſcribed hereafter.

Internal eminences and cavities.

279. The internal eminences and cavities are as follow: the greateſt part of the foſſa naſalis; the anterior criſta of the nares, which is high and narrow; the poſterior criſta of the nares, which is low and broad, theſe two criſtæ are a continuation of the ſpine of the nares, N° 275. and are ſo diſpoſed as to form a long groove for the reception of the ſeptum narium, when the two maxillary bones are joined together: a perpendicular and pretty hollow groove, wide towards the upper part, narrow towards the lower, which makes the inferior portion of the lachrymal duct.

280 Alſo the anterior ductus palatinus on one ſide of the anterior criſta, and near the ſpine of the nares; this duct in its courſe downwards, joins that of the other jaw, and both together form the anterior foramen palatinum, or inciſorium, which is often very complex: a ſmall anterior eminence or tranſverſe line, between the naſal opening, and the lower end of the lachrymal duct, which ſuſtains the fore part of the concha narium inferior: a rough broad impreſſion on the maxillary tubercle, on both ſides of the paſſage of the foramen palatinum, by which this bone is joined with the Os Palati; a ſmall poſterior eminence or tranſverſe line, covered with a lamina of the Os Palati, which ſuſtains the inequalities of the poſterior end of the concha narium inferior, by the intervention of a lamina of the Os Palati, as we ſhall ſee afterwards.

281. Laſtly, the maxillary ſinus, which is a large cavity under the orbit, in the orbitary apophyſis. It extends to the ſuture of the Os Malæ, to the ſpheno-maxillary-fiſſure, to the inferior orbitary hole, and below to the ſockets. Towards its upper edge, there are ſometimes cells, which communicate with the Os Ethmoides. It opens between the two conchæ

narium, behind the lachrymal duct, by one or more orifices, formed partly by a portion of the Os Palati, partly by a portion of the concha narium inferior, and ſometimes partly by a portion of the Os Unguis. Theſe openings are all much higher than the bottom of the ſinus.

282. I ſay nothing here of the ſeparation of this bone by a ſmall tranſverſe ſuture, behind the foramen inciſorium; becauſe it is ſeldom found but in young ſubjects before the oſſification is completed.

Subſtance. 283. The maxillary bone is almoſt all compact, and without diploë, except in the alveolary arch, and at the point of the orbitary apophyſis.

Situation in particular. 284. To put this bone in its true ſituation, the naſal apophyſis muſt be turned upwards, the alveolary arch downward, and the ſpine of the nares foreward.

Connection. 285. The maxillary bones are connected with the Os Frontis, Os Ethmoides, Os Sphenoides, Oſſa Unguis, Oſſa Malarum, Oſſa Naſi, Oſſa Palati, Vomer, conchæ narium inferiores, and with each other.

Uſes. 296. They aſſiſt in forming the organ of maſtication, the arch of the palate, the cheeks, the orbits, the noſe, &c.

§ 9. *Oſſa Malarum.*

Number and ſituation in general. 287. The Oſſa Malarum, called alſo Oſſa Zygomatica, and Malaria, are two in number, ſituated in the lateral and middle parts of the face.

Figure. 288. They are in ſome meaſure triangular, or irregularly ſquare.

Diviſion. 289. They are divided into two ſides, the external gently convex, the internal unequally concave.

Eminences. 290. The eminences in each bone are the ſuperior or angular orbitary apophyſis, which joins by ſuture with the external angular apophyſis of the Os Frontis, and aſſiſts in forming the external angle of the orbit: from this apophyſis another ſubaltern proceſs runs inward on the inſide of the bone, one ſide of which forms a portion of the orbit; the other, a portion of the zygomatic foſſa; the inferior or maxillary orbitary apophyſis, which, with the angular apophyſis, forms the inferior external portion on of the orbit: the apophyſis malaris, which is in ſome meaſure the baſis of the reſt, and together with the apophyſis maxillaris, joins the orbitary apophyſis of the Os Maxillare: the zygomatic apophyſis, which makes a part of the zygoma, and alſo of the zygomatic foſſa.

291. The cavities are the great orbitary ſlope, which makes the inferior external portion of the edge of the zygomatic notch above the zygoma: one or more little holes on the outſide and in the orbitary apophyſes. *Cavities.*

292. Each bone is compoſed of two pretty compact tables, with a ſmall quantity of diploë between them, except in the anterior part of the apophyſis malaris. *Subſtance.*

293. The true ſituation will be eaſily fixed, by conſidering what has been ſaid about the ſides and apophyſis of this bone. *Situation in particular.*

294. The Os Malæ on each ſide is joined to the Os Frontis by the angular apophyſis, to the Os Sphenoides by the ſubaltern apophyſis, to the Os Temporis by the zygomatic apophyſis, and to the Os Maxillare by its baſis. *Connection.*

295. Theſe bones make the prominent upper part of the cheeks, moſt remarkable in lean perſons. They form likewiſe a portion of the orbit, and complete the zygomatic arches. *Uſes.*

§ 10. *Oſſa Naſi.*

296. The proper bones of the noſe are two in number, joined together, and ſituated below the forehead, between the two naſal apophyſis of the Oſſa Maxillaria. *Number and ſituation.*

297. Each of theſe bones comes near the figure of an oblong ſquare, the upper extremity being narrow and thick, the lower oblique and thin; the middle part bent inwards near the upper end in ſome ſubjects, in others almoſt ſtraight. The two bones joined repreſent a ſort of ſaddle. *Figure.*

298. Each of them is divided into two ſides, one anterior or external, the other poſterior or internal; two extremities, one upper, the other lower; and two edges, one external, the other internal. *Diviſion.*

299. The anterior ſide is convex, though a little depreſſed or hollowed above the middle. The poſterior ſide is gently concave. The upper extremity is very thick, full of points and depreſſions. The lower extremity is thin, unequally indented, and cut obliquely in ſuch a manner, as that the two bones, joined together, form an acute ſlope. The inner edge contiguous to the ſame edge of the other bone, is even, except near the upper part, where they are united by a kind of ſuture. From this edge, a little eminence runs inward or backward, (which is ſometimes wanting in one of the bones); and when they are joined, theſe eminences repreſent a ſort of criſta or prominent line, anſwering to the ſeptum narium. About the middle of the outſide, ſometimes higher, ſometimes lower, there is a hole, which is ſometimes wanting in one of the bones, and ſometimes there are ſeveral holes in each.

Subſtance. 300. The ſubſtance is compact, ſometimes however we meet with a ſmall quantity of diploë at the upper end.

Situation in particular. 301. The particular ſituation of theſe bones is eaſily underſtood by the deſcription.

Connection. 302. They are joined to each other, partly by ſuture, and partly by harmony. They are joined above to the naſal apophyſis of the Os Frontis, laterally to the naſal apophyſes of the Oſſa Maxillaria, and interiorly or poſteriorly to the anterior edge of the perpendicular lamina of the Os Ethmoides, by means of the prominent line already mentioned.

Uſes. 303. They form the anterior and upper portion of the noſe, and part of the ſeptum narium.

§ 11. *Oſſa Unguis.*

Number, ſituation and ſize. 304. The Oſſa Unguis or Lachrymalia are two in number, each being ſituated in the orbit, at the lower part of the internal angle. They are the leaſt bones of the face, very thin and tranſparent.

Figure. 305. They are longer than they are broad, reſembling in ſome meaſure the nail of a finger, (from whence they have their name), eſpecially when in ſitu;

for being taken out of the ſcull, their figure is more irregular.

306. Each of them is divided into two ſides, one external, the greateſt part of which appears in the orbit, in an entire ſcull, the other internal, which is hid; two extremities, one upper, the other lower, and two edges, one anterior, the other poſterior. *Diviſion.*

307. The outſide is ſmooth, and a little concave. Towards the anterior edge, is a groove full of ſmall holes, like a ſieve, called the *lachrymal groove.* It begins at the upper extremity, and runs down lower than any other part of this ſide of the bone, the lower extremity of it being hid by the Os Maxillare. It is diſtinguiſhed from the reſt of the outſide, by a very ſharp prominent edge.

308. The inſide is rough and unequally convex, with a perpendicular depreſſion, anſwering to the ſharp prominence on the outſide. On the upper part of this inſide, ſmall portions of cellulous laminæ are ſometimes obſervable, which communicate with the entry of the frontal ſinus. There are likewiſe ſome about the middle, which complete the anterior ethmoidal cells; and others towards the lower end, which communicate with the rugged portions of the upper border of the ſinus maxillaris. Theſe often vary, and are ſometimes wanting.

309. Theſe bones are altogether without diploë. *Subſtance.*

310. What has been ſaid about the two ſides and lachrymal groove, ſufficiently determines the ſituation. *Situation in particular.*

311. They are connected with the Os Frontis, with the Os Ethmoides, covering a part of the cells in that bone, with the naſal apophyſis of the Os Maxillare, and with the groove of that bone, in ſuch a manner, as that the two grooves joined together form an entire tube, called the *lachrymal duct.* They alſo cover a little the opening of the maxillary ſinuſſes, and join the inferior conchæ of the nares, of which they appear to be only a continuation in an advanced age. *Connection.*

312. The uſes of them are to complete the internal ſides of the orbit, to cover the forepart of the labyrinth of the noſe, and to form the lachrymal duct. *Uſes.*

§ 12. *Oſſa Palati.*

313. The bones of the palate are two, ſituated in the poſterior part of the arch of the palate, between the pterygoide apophyſes, and the Oſſa Maxillaria, and running up on the ſides of the naſal foſſæ, all the way to the bottom of each orbit.

Number and ſituation in general.

314. The figure of theſe bones is not ſquare, as is ſaid by thoſe who have only ſeen that portion of them which belongs to the palate, and from thence have named them *Oſſa Palati.* The entire bone is crooked, hooked, pointed, and uneven, though but of a ſmall ſize.

Figure.

315. Each of them may be divided into four portions, one ſuperior, one middle, and two lower; whereof one is anterior, the other poſterior.

Diviſion.

316. The lower and anterior portion, which I call *portio palatina*, is the baſis or body of the bone, and the only part of it which the ancient anatomiſts have obſerved, Vidus Vidius excepted. It completes the arch of the palate, and the bottom of the naſal foſſa. The inner edge of it is raiſed, and that joined to the like edge of the other bone, forms a groove, which receives part of the ſeptum narium, in the ſame manner, as the other part of it is received in a like groove of the Oſſa Maxillaria. The poſterior edge is gently ſloped, and ends inwardly in a point which joins a like point in the other bone.

317. The lower and poſterior portion, which I name *pterygoide*, is pointed and hollowed on each ſide, to join the pterygoide apophyſis, of which it completes the foſſa, being fixed like a wedge in the irregular notch of that proceſs. Exteriorly it is uneven, the better to be connected with the Os Maxillare. This portion is diſtinguiſhed from the portio palatina, and alſo from the middle portion, by an oblique half-canal, which, with the half-canal in the maxillary tubercle, forms an entire canal, the lower end of which is the poſterior foramen palatinum.

318. The middle portion to which I give the name of *naſal*, is very thin, and is ſituated laterally. It has an internal and external ſide. The internal ſide is a little concave, being turned toward the nares, and at the lower part of it there

is a tranſverſe eminence or bony line which diſtinguiſhes this portion from the portio palatina. The outſide is a little convex, and partly covers the opening of the maxillary ſinus. At the lower part of it, is a tranſverſe groove, anſwering to the eminence on the other ſide, and moulded, as it were, by the poſterior tranſverſe eminence of the Os Maxillare.

319. The upper portion, which I call *orbitary*, is diſtinguiſhed from the naſal portion, by a notch, which, together with the pterygoide apophyſis of the ſphenoidal bone, forms an opening more or leſs conſiderable, which may be called *foramen ſpheno-palatinum*, or *pterygo-palatinum*. This portion has five little ſides, three of which are rather cavities; one ſuperior, which completes the extremity at the bottom of the orbit, and is more or leſs flat, very ſmall, ſmooth, and triangular; one anterior, which is a little hollow, covering the upper part of the maxillary tubercle, and by a ſmooth raiſed edge completing the fiſſura ſpheno-maxillaris; the third ſide is likewiſe anterior, more hollow than the former, joining the back part of the labyrinth of the Os Ethmoides: the fourth is poſterior, more or leſs hollow, anſwering to the ſphenoidal ſinus: the fifth is lateral and external, covering the poſterior and upper part of the maxillary ſinus. It muſt be obſerved, that theſe ſides and cavities vary, being ſometimes ſingle, ſometimes complex.

320. There is very little diploë in theſe bones, except in the palatin and pterygoide portions. *Subſtance.*

321. By conſidering the diviſion of theſe bones already mentioned, it is eaſy to put them in their true ſituation. *Situation in particular.*

322. They are joined to each other by the portio palatina, to the vomer by the common groove formed by their raiſed edges, to the maxillary bones before, and laterally, to the ſphenoidal bone behind, to the inferior ſhells of the nares, by their tranſverſe eminences; and laſtly by their orbitary portions to the Os Ethmoides, Oſſa Maxillaria, and Os Sphenoides. *Connection.*

323. They complete the arch of the palate, the pterygoide and naſal foſſæ, and the orbit; they aſſiſt in ſupporting the vomer and conchæ narium inferiores. *Uſes.*

§ 13. *Vomer.*

Situation in general. 324. The ſituation of the vomer is perpendicular between the two naſal foſſæ backward.

Figure. 325. The figure of it is nearly that of an oblique ſquare, having ſome reſemblance to a ploughſhare, from which it has its name.

Diviſion. 326. It is divided into two ſides, one to the right, the other to the left, both of them unequally flat; and into four edges, the ſuperior, inferior, anterior, and poſterior.

327. The upper edge is an horizontal groove which receives the ſharp proceſs or roſtrum of the Os Sphenoides. This groove is broad and a little notched backward; the forepart of it is narrower, and ends in a ſtrait canal, which runs downward and forward in an oblique direction, dividing the bone, as it were, into two laminæ.

328. The anterior edge is oblique and very unequal. It may be divided into two parts, one anterior, the other poſterior. The poſterior part is ſmall and thin, and ſupports the perpendicular lamina of the Os Ethmoides. The anterior part is larger, with a pretty deep groove, continued from the canal in the upper edge, which ſuſtains the cartilaginous ſeptum of the nares.

329. The lower edge is likewiſe unequal, and near its anterior extremity, is an angle which divides it into two parts; one anterior, very ſhort, which is ſet in the criſta narium; the other poſterior and much longer, ſet in the common groove of the Oſſa Maxillaria and Palati. The angle by which this edge is divided lies in the notch formed by the criſta narium and the groove of the maxillary bones.

330. The poſterior edge is oblique and ſharp, becoming inſenſibly more obtuſe as it approaches to the large groove in the upper edge.

Subſtance. 331. This bone has but very little diploë.

Situation in particular. 332. To ſituate it right, we need only attend to the deſcription of its parts.

Connection. 333. It is connected with the Os Sphenoides, Os Ethmoides, Oſſa Maxillaria, and Oſſa Palati in the manner already ſaid.

334. Its uſe is to form the poſterior part of the ſeptum narium. *Uſe.*

§ 14. *Conchæ Narium inferiores.*

335. The inferior ſhells of the nares are two in number, ſituated in the naſal foſſa, under the openings of the maxillary ſinus, and immediately above the inferior orifices of the lachrymal ducts. They cover theſe orifices much in the ſame manner as the ſuperior conchæ of the ethmoidal bone cover the maxillary openings. They are likewiſe termed *the inferior ſpungy laminæ of the noſe.* *Number and ſituation in general.*

336. Their figure is very much like that of the ſuperior ſhells. *Figure.*

337. Two ſides are diſtinguiſhable in each of them, one internal, and one external; as likewiſe two extremities, the anterior and poſterior; three edges two ſuperior, one ſmall, the other great, and one inferior; and, laſtly, two apophyſes, one ſmall or ſuperior, the other large or lateral. *Diviſion.*

338. The inſide is gently convex, being turned towards the ſeptum narium; the outſide is proportionably concave, turned towards the maxillary ſinus. Both ſides are rough and uneven.

339. The extremities are pointed, but the poſterior more than the anterior.

340. The inferior edge, the moſt conſiderable of the three, is rough, thick, a little rounded and turned outward, that is, toward the Os Maxillare. It is ſuſpended like the ethmoidal concha, without reſting on any thing.

341. The ſmall or anterior upper edge is thin, uneven, and of the ſame length with the anterior tranſverſe eminence of the Os Maxillare to which it is joined. The large or poſterior upper edge is longer than the other, and is joined backward to the ſmall tranſverſe eminence of the middle portion of the Os Palati. Theſe two ſuperior edges are diſtinguiſhed by an obtuſe angle formed by them. The great edge is a large thin apophyſis in ſhape of a nail, which runs down on the inner or concave ſide of the bone. This apophyſis, which is the greateſt of the two already mentioned, is ſometimes ſmooth, ſometimes uneven, divided and notched.

ed. It partly covers the maxillary ſinus, and helps to make the opening thereof.

342. The ſmall or ſuperior apophyſis, is a thin plate, which divides the two upper edges, It is, as it were, a ſmall portion of a groove, which, joined to the lower end of that in the Os Unguis, completes the lachrymal canal, and in adults it has appeared to be a true continuation of the laſt named bone, as if the inferior concha of the nares and Os Unguis were both one piece.

Situation in particular. 343. The true ſituation of theſe bones is ſufficiently ſhewn in what has been ſaid about their ſides, extremities, and edges.

344. They are connected with the Oſſa Maxillaria, Oſſa Palati, Oſſa Unguis, and ſometimes with the Os Ethmoides, of which they appeared in one ſubject to be a true continuation. In moſt ſkeletons, theſe connections are but very ſlender, and therefore theſe bones are eaſily loſt, which is the reaſon why the ancients have not obſerved them. *Connection.*

Uſes. 345. They complete the bony ſtructure of the noſe, augment its ſurface, and render it proportionable to the extent of the organ of ſmell, and of the pituitary membrane.

§ 15. *Maxilla Inferior.*

Situation in general. 346. The lower jaw is but one bone in adults, and makes the lower part of the face, being ſituated there.

Figure. 347. It bears ſome reſemblance to a bow, with the ends bent upwards.

348. It may be divided into a body and branches. The body is that portion which repreſents a bow: the branches are the extremities bent upward. In the body, we diſtinguiſh an anterior portion, called the *chin*, two lateral portions; two ſides, one internal, and one external; and two edges, one ſuperior, which is the alveolary arch of this jaw, and one inferior, called the *baſis*, and divided into an external and internal labium. This baſis ends poſteriorly in a crooked portion, termed *the angle of the lower jaw.* *Diviſion.*

349. In the middle of the anterior ſide of the chin is a per-

pendicular eminence or line which marks the place where this bone is divided in children, and, for that reaſon, named *the ſymphyſis of the lower jaw.* On each ſide of the ſymphyſis, are two muſcular impreſſions, one high, the other low, more or leſs excavated, and in ſome ſubjects diſtinguiſhed by a ſmall tranſverſe eminence. The external labium of the baſis of the chin is a little prominent, and bordered on each ſide by eminences more or leſs conſiderable, by which the chin appears to be diſtinguiſhed from the lateral parts of the body of the bone.

350. The backſide of the chin is concave, and inequalities are ſeen in it, through the whole length of the ſymphyſis. From the upper edge, to the middle of the ſymphyſis, or thereabouts, runs a ſuperficial aſperity, broader below than above, and more remarkable in the ſymphyſis, than on either ſide. Immediately below this aſperity, there are ſeveral tuberoſities more or leſs raiſed and rough, the loweſt of which is on the internal labium of the baſis. On each ſide of the uppermoſt tuberoſity, is a large ſhallow impreſſion. At the very loweſt border of the internal labium of the baſis, on each ſide of the ſymphyſis, there is a pretty large muſcular impreſſion, with a tranſverſe aſperity between them, which in a manner joins them to each other. We ſometimes meet with ſmall holes in the upper part of the ſymphyſis, and near it.

351. The outſide of each lateral portion of the body of the bone is a little convex. On each ſide of the chin is a pretty large hole, which is the anterior orifice of a canal hereafter to be deſcribed. There is alſo a long eminence or elevation, which beginning at the baſis, near the forementioned hole, runs obliquely upward and backward toward the branch of the jaw, growing more prominent as it aſcends. The lower edge of this ſide ſometimes juts out a little.

352. In the inſide of this lateral portion, a little below the alveolary edge, there is likewiſe a long eminence, leſs oblique, but more prominent, which runs upward and backward, much in the ſame manner with that on the outſide.

353. The poſterior curve portions are the flatteſt of all, and repreſent a ſort of oblong ſquare, irregular, and a little oblique. In each of theſe branches, two ſides are to be taken notice of, one internal and one external; alſo two apophyſes in the upper part of them, one anterior, called the *coronoide apophyſis*, and one poſterior, called the *condyloide apophyſis*; a

large opening between the two apophyſes; and laſtly, an angle by which the poſterior and lower part or baſis of the branch is terminated.

354. The anterior or coronoide apophyſis is flat, ſharp at the upper end, broad at the lower, ſomething uneven on the outſide, and a little prominent about the middle of the inſide, by the continuation of the internal oblong eminence of the lateral portion. The anterior edge of this apophyſis is a continuation of the oblique external emience of the ſame portion.

355. The poſterior apophyſis is termed *condyloide*, becauſe it ends in a head reſembling a condyle, ſet upon a kind of neck. This condyle is oblong, and ſituated almoſt tranſverſely, the internal extremity of it being only turned a little backward, and the external forward, which direction anſwers to that of the articular eminence and cavity of the Os Temporis, with which this condyle is articulated. It advances more toward the inſide than toward the outſide of the bone, and the neck is bent a little forward. This neck is convex on the back-part, and on the fore-part there is a muſcular foſſula immediately under the condyle.

356. The great opening between the apophyſes has a ſharp border, which is, as it were, a continuation of the poſterior edge of the coronoide apophyſis, it is in the ſhape of a creſcent, and ends at the outer extremity of the condyle on the outſide of the foſſula in its neck.

357. The outſide of the branch is very full of ſuperficial inequalities or muſcular impreſſions, eſpecially near the angle. This angle is blunt, uneven, and turned more or leſs toward the outſide.

358. The inſide has the ſame ſort of inequalities towards the angle. About the middle of this ſide is a very irregular hole, being the internal orifice of a large canal, which, after having run down a little way in the middle ſubſtance of the branch, changes its direction, continuing its courſe through the middle of the lateral portion, all the way to the hole near the chin, which is its external orifice, and then loſes itſelf in the ſubſtance of the chin. The internal orifice of this canal is broad above, oblique, flat, more or leſs notched, and in ſome meaſure lacerated. A little below this orifice are ſometimes found two little holes, one above, and at ſome diſtance

from the other; which are the orifices of a very ſmall canal running immediately under the ſurface of the bone. This canal is the continuation of a ſmall groove, which begins at the edge of the orifice of the great canal, and from thence runs a very little way down. In ſome ſubjects, we find only this groove without any canal.

359. The upper edge of the body of the lower jaw is pierced by ſixteen holes and foſſulæ, called *ſockets*, which contain the like number of bones, called *teeth*; both which I ſhall deſcribe together.

Subſtance.

360. This bone appears to have a larger ſhare of diploë in proportion to its ſize, than any other bone of the face, eſpecially near the alveolary arch. The tables are very ſolid, and not equally thick in all parts.

Situation in particular.

361. There is no difficulty in determining the ſituation of the lower jaw.

Connection.

362. The lower jaw is connected with the Oſſa Temporum by a very ſingular kind of articulation, partaking of the nature both of a ginglymus and arthrodia, and therefore I term it *amphidiarthroſis.* Its principal motions are upward and downward, and in all the different degrees thereof we can thruſt it forward, pull it backward, and turn it to either ſide; and in the ſame manner, in any degree of motion forward, backward, or laterally we can raiſe or depreſs it. The mechaniſm of this articulation, and the motions thereof depend alſo on a cartilage, which not being found in the ſkeleton, the deſcription of it muſt be referred to that of the freſh bones.

§ 16. *Dentes.*

363. The teeth are the hardeſt, moſt ſolid, and whiteſt parts of the whole ſkeleton.

Number, ſituation in general, and figure.

364. In an adult perſon they are generally thirty-two in number, ſixteen placed in the lower edge of the upper jaw, and ſixteen in the upper edge of the lower jaw. They are all fixed in their ſockets, like ſo may little wedges or ſtakes, the heads and points of which are different from each other.

365. The teeth in each jaw are divided into three claſſes;

Diviſion and ſituation in particular. the firſt, including the four anterior teeth, called *inciſores*; the ſecond, including the two next, one on each ſide, named *canini*; and the third, including the other ten, five on each ſide, named *molares*.

366. In each tooth we diſtinguiſh two portions, one without the ſocket, called the *body of the tooth*, and in the dentes molares, the *crown*; the other within the ſocket, called the *root of the tooth*. Theſe two portions are divided by a kind of circular line, which may be termed the *collar of the tooth*. When the teeth are in ſitu, the roots of the ſuperior row are turned upward, the bodies downward; in the lower row, the roots are turned downward, and the bodies upward.

367. The inciſors are ſo called from a Latin word, which ſignifies *to cut* or *divide*. They were likewiſe called formerly *dentes riſorii*, becauſe they appear in laughing. The four upper inciſors are larger and broader than the four lower; and of the upper, the two in the middle are larger than the other two.

Dentes inciſores.

368. The bodies of theſe teeth reſemble ſharp cutting wedges, and their roots pointed wedges. The bodies are ſo diſpoſed, as that their ſharp edges lie all in a line, making one uniform edge. Each body has four ſides, one anterior, a little convex; one poſterior, a little concave; and two lateral, much narrower than the former, and almoſt flat. The anterior and poſterior ſides decreaſe in breadth towards the collar, the lateral ſides towards the edge; ſo that they repreſent in ſome meaſure four triangles with their apices and baſes reciprocally oppoſite.

369. Theſe teeth have long roots; their lateral ſides are broad and flat, the anterior and poſterior ſides narrow, and they terminate by degrees in a point, in which a ſmall hole is obſervable, pretty conſiderable in children, but obliterated in old age.

370. The *dentes canini* are ſo termed, becauſe they are naturally a little pointed, and appear longer than the reſt, almoſt the ſame manner as in dogs. They might likewiſe be called *angular*, becauſe they make a ſort of angle by which the inciſors are ſeparated from the grinders. The two ſuperior have alſo been named *eye-teeth* from their ſituation.

Dentes canini.

371. The bodies of them are thicker and more prominent

than the inciſors, convex and a little rounded on the outſide, and ending in a ſhort triangular point, one of the ſides of which is a continuation of the convexity of the outſide, the other two are flatter and turned inwards. Theſe points are often worn out by maſtication. The roots are commonly larger, thicker, longer, and more pointed, than thoſe of the inciſors, and ſometimes perforate the bottom of the maxillary ſinus.

372. The *dentes molares* are ſo called, becauſe they ſerve as ſo many mills to grind the food. They are generally twenty in number, five placed on each ſide of both jaws; immediately after the canini. The two firſt in each row are ſmall, the two next larger; as is alſo the laſt, which appears very late, and is often wanting; and from thence the molares have been diſtinguiſhed into ſmall grinders, large grinders, and dentes ſapientiæ, becauſe they ſeldom appear till men arrive at the years of diſcretion.

Dentes molares.

373. Their bodies in general are ſhort, very thick, irregularly cylindrical, or rather with four ſides a little rounded, and terminated by a broad end more or leſs filled with obtuſe points cut, in ſome meaſure, like ſo many diamonds. The name of *crown* is moſt frequently given to the bodies of theſe teeth, the reſemblance being greater than in the others.

374. In the two ſmall molares, the crown is leſs than in the others, and often not ſo large as the bodies of the canini: they have commonly but two points: though ſometimes the ſecond appears to have three. In the two large molares, the crown has a much greater extent, and the points are three, four, or five in number. The fifth grinder, or dens ſapientiæ, has a crown much like the two former, but often more rounded and with fewer points.

375. The roots of the molares are long and more or leſs flat; ſingle in ſome of them, in others, two, three, four, but rarely five in number. Sometimes all theſe roots are diſtinct, ſometimes wholly united, and ſometimes united only in part. They are generally ſtraight, and at a greater diſtance from each other at the extremities, than at the crown of the tooth.

376. The roots of the ſmall grinders appear often ſingle without being ſo in reality; for in examining them narrowly, we find they have two roots, united, or, as it were, ſoldered

together. Sometimes all the diſtinction that appears is in two ſeparate points.

377. The great molares have commonly ſeveral roots; the firſt three, and the ſecond four; or the firſt four, and the ſecond ſometimes five; but theſe numbers are variable. Theſe roots are ſometimes all perfectly diſtinct; ſometimes they are partly diſtinct, and partly united in the ſame tooth, in different degrees. In ſome ſubjects one or more of their points are bent outward, inward, or in other directions; and we do not always meet with more roots in the upper teeth than in the lower.

378. The fifth grinder has often but one root, ſometimes very ſhort, and ſometimes very long. We meet with this tooth even in grown perſons almoſt wholly hid in its ſocket, which has then but a very ſmall opening. Laſtly, it ought to be remarked concerning all the molares, that, near the collar, their roots unite in a ſort of trunk.

Subſtance.

379. In an adult perſon, the teeth in general, are very compact and ſolid. A very narrow cavity goes from the body to the point of the root, where it ends in a ſmall hole, which at length perhaps becomes imperceptible, and even quite diſappears. But to be more particular, the outer ſubſtance of the teeth is different from the inner; and that of the body from that of the root.

380. The bodies of the teeth are cruſted over with a ſubſtance much harder than the reſt, naturally very white, poliſhed, and ſhining, looking like the imperfect vitrification of china-ware, or like enamelling; and nothing can deſtroy it but the file or corroſive liquors, It may be called the *enamel of the teeth*. The roots have ſome ſmall ſhare of it, but not near ſo much as the bodies.

381. When viewed through a microſcope, this ſubſtance appears to be made up of ſhort fibres, the radiated extremities of which are turned both inwards and outwards. The inner ſubſtance of the teeth is the ſame with that of the other bones, only harder than any of them, except the apophyſis petroſa of the Os Temporis.

Connection.

382. The teeth are connected with the ſockets in both jaws by an articulation without motion, called *gomphoſis*. They are fixed in the ſockets like pins or nails, their roots being exactly ſurrounded by the

ſpungy ſubſtance or diploë; and appearing like moulds for the cavities of the ſockets, which are rather porous vaginæ than ſpungy foſſulæ. The trunk of the root is ſurrounded by the common orifice of the ſocket, at a ſmall diſtance from the circular line or collar. The upper and lower teeth meet in ſuch a manner, as that the firſt, and eſpecially the inciſors, advance moſt forward and run over the latter, the arch of the lower teeth appearing to be ſmaller than that of the upper.

383. In general, the teeth ſerve for maſtication or chewing. In particular, the inciſores tear and cut the food; the canini break it to pieces, and the molares bruiſe and grind it. The teeth, eſpecially the inciſores, contribute, likewiſe, to the articulation of ſounds. *Uſes.*

§ 17. *Os Hyoides.*

384. The Os Hyoides or bone of the tongue is ſituated in the middle ſpace between the angles of the lower jaw. It is a little bone, and reſembles, in ſome meaſure, the baſis of the lower jaw, or a ſmall bow. The ancient Greeks compared it to one of the vowels in their language, and from thence came the name of *Os Hyoides*, *Yoides*, or *Ypſiloides*. *Situation in general and figure.*

385. It is diſtinguiſhed into the baſis, which is the anterior part; two large cornua, which are the lateral parts, and two ſmall cornua, or appendices, which are the ſuperior parts, to the upper end of which other appendices are frequently joined. *Diviſion.*

386. The baſis is the broadeſt and thickeſt part. It is ſituated tranſverſely, and two ſides may be diſtinguiſhed in it, one anterior, unequally convex, and one poſterior, unequally concave: it has likewiſe two edges, one ſuperior, and one inferior; and two extremities, one to the right, and one to the left. The angles of it might likewiſe be diſtinguiſhed.

387. In the middle of the fore-ſide is a perpendicular eminence, which divides it into right and left portions, and which terminates above in a ſmall pointed tubercle, with a ſmall hollow impreſſion on each ſide. At the lower end of this eminence there are alſo two ſuch impreſſions, but much larger. Near each extremity we find inequalities, which end

in the angles of the baſis. The backſide, as has been already ſaid, is hollow.

388. The large cornua are joined to the extremities of the baſis by cartilaginous ſymphyſis, which in adults become long. In each cornu we diſtinguiſh the root, or anterior extremity, the point, or poſterior extremity, and the middle portion. The length of each cornu is near double that of the baſis. The roots are thick and broad, and by them the cornua are joined to the baſis. The lower part of the middle portion is a little crooked, and alſo broader than the reſt. The points end in a little cartilaginous head; and in the natural ſtate, a ſhort ligament with a little round bone or cartilage, runs down from each of theſe heads, as we ſhall ſee in examining the freſh bones.

389. The ſmall cornua are placed on the ſymphyſes of the large ones, almoſt perpendicularly, being only inclined a little outward and backward. They are joined by a cartilaginous ſymphyſis peculiar to them; and are themſelves cartilages in young people, but they afterwards oſſify, though not always at the ſame age, and at laſt their ſymphyſes are loſt. The length of theſe cornua varies pretty much; and at the upper extremity of each of them, we ſometimes meet with one or more additional portions, in the ſhape of little oblong pearls, or of little pillars ſet upon one another, and held together by a kind of ligament more or leſs cartilaginous, of which hereafter. The ſubſtance of theſe appendices is different in different ages, in the ſame manner as that of the cornua themſelves.

Connection.

390. The connection of the Os Hyoides, not being by articulation, does not belong to the deſcription of the ſkeleton, and therefore muſt be referred to the account of the freſh bones, and of the tongue. It will be ſufficient to obſerve here, that it is connected by a ligamentary ſymphyſis with the ſtyloide apophyſis, the cartilago thyroides of the trachea arteria, and the epiglottis: it is alſo connected by muſcles, with other parts, as we ſhall ſee hereafter.

Uſes.

391. The chief uſe of this bone is to be the baſis and ſupport of the tongue. The pliableneſs of the ſmall cornua are likewiſe believed to contribute to the perfection of ſinging.

§ 18. *The*

§ 18. *The bony parts of the organ of hearing.*

Situation in general.

392. All the bony parts of the organ of hearing, or bones of the internal ear, being contained in the inferior portions of the Oſſa Temporum; it will be very proper to recollect what has been already ſaid about theſe, N° 255. *&c.* and eſpecially to conſider well the particular ſituation of the apophyſis petroſa, its baſis, apex, and ſides, and alſo of the maſtoide apophyſis, with the eminences, cavities, holes, *&c.* which lie thereabouts.

393. All the bony organ of hearing may very naturally be divided into four general parts: 1. The external meatus auditorius; 2. The tympanum, or barrel of the ear; 3. The labyrinth; 4. The internal meatus auditorius. It may likewiſe be divided into immoveable or containing parts, which take in all the four already mentioned; and moveable or contained parts, which are four little bones lodged in the tympanum, called *incus*, *malleus*, *ſtapes*, and *Os Orbiculare* or *Lenticulare*.

External meatus auditorius.

394. The external auditory paſſage begins by the external auditory hole, the edge of which is rough and prominent; but backwards towards the maſtoide apophyſis it appears very much ſloped. The paſſage itſelf is about half an inch in length, running obliquely from behind forward, in a curve direction, and ſometimes winding a little in the middle, like a ſcrew. Its cavity is almoſt oval, wider at the entry than at the middle, after which it widens again by degrees.

395. It terminates inwardly by an even circular edge lying in a plane very much inclined, the upper part of it being turned outward, and the lower part inward; ſo that the whole canal is longer on the lower ſide than on the upper. The concave ſide of the circular edge is grooved quite round.

396. In children this bony canal is wanting, as well as the maſtoide apophyſis; and the inner circular edge is a diſtinct ring, which, in an advanced age, unites entirely, and becomes one piece with the reſt. It is termed the bony circle in infants, and indeed it is very eaſily ſeparated from all the other parts.

397. It would ſeem therefore that the whole bony canal

in adults is only a prolongation of the bony circle in children; becauſe even in a more advanced age, the whole canal may without much difficulty be taken out. The circular groove lies between the maſtoide apophyſis and the articular fiſſure or crack.

Figure and ſituation of the tympanum.

398. The tympanum or barrel of the ear is a cavity irregularly ſemiſpherical, the bottom of it being turned inward, and the mouth joined to the circular groove already mentioned. Both eminences and cavities are obſervable in it.

Eminences.

399. The remarkable eminences are three in number; a large tuberoſity lying in the very bottom of the barrel, a little toward the back part; and a ſmall irregular pyramid ſituated above the tuberoſity, and a little more backward; the apex of it is perforated by a ſmall hole, and on one ſide of the baſis, two ſmall bony filaments are often found in a parallel ſituation, and indeed, I believe they are ſeldom wanting, though their tender ſtructure expoſes them to be often broken: in the third eminence is a cavity ſhaped like the mouth of a ſpoon, ſituated at the upper and a little towards the anterior part of the bottom of the tympanum. This cavity is part of a half-canal, of which hereafter; and at a very ſmall diſtance from its point is a little bony ridge which goes from one edge of it to the other, but is ſometimes not entire.

Cavities.

400. The principal cavities in the tympanum are, the opening of the maſtoide cells or ſinuoſities; the opening of the Euſtachian tube; the bony half-canal; the feneſtra ovalis and rotunda; and to theſe may be added the ſmall hole in the pyramid.

401. The opening of the maſtoide cells is at the poſterior and upper parr of the edge of the barrel. The cells themſelves which end there are dug in the ſubſtance of the maſtoide proceſs, being very irregular and full of windings and turnings.

402. The opening of the Euſtachian tube is at the anterior and a little toward the upper part of the edge of the barrel. This tube, in France generally termed the *aqueduct*, runs from the tympanum, towards the poſterior openings of the naſal foſſæ, and arch of the palate. The bony portion thereof, of which alone I here ſpeak, is dug in the apophy-

ſis petroſa along the duct of the carotide apophyſis, and when it leaves that, it is lengthened out by the ſpinal apophyſis of the Os Sphenoides. Theſe two cavities, the maſtoide cells, and the Euſtachian tube, are, in ſome meaſure, prolongations of the tympanum, one anterior, the other poſterior.

403. The bony half canal, of which the cavity reſembling the mouth of a ſpoon is the extremity, lies immediately above the Euſtachian tube, towards the upper ſide of the apophyſis petroſa; or rather in the very ſubſtance of that upper ſide. In a natural ſtate, a ſmall muſcle is lodged in it.

404. The feneſtra ovalis is a hole of communication between the tympanum and labyrinth. It lies immediately above the tuberoſity, the upper ſide of it being a little rounded, the lower a little flatted; and one extremity being turned forward, the other backward. Towards the labyrinth, this opening has a little flat thin border quite round it, which renders it narrower at that place than any where elſe.

405. The feneſta rotunda is ſomething leſs than the ovalis, and ſituated in the lower and a little towards the poſterior part of the large tuberoſity; the opening of it, which is the orifice of a particular duct in the labyrinth, lying obliquely backward and outward.

406. The hole in the apex of the pyramid is the orifice of a cavity which may be named the ſinus of this pyramid.

Oſſicula auditus.

407. The tympanum contains ſeveral little bones, called the *bones of the ear*. They are generally four in number, denominated from ſomething to which they are thought to bear a reſemblance, *viz.* Incus, Malleus, Stapes, and Os Orbiculare or Lenticulare.

Incus.

408. The incus or anvil reſembles, in ſome meaſure, one of the anterior grinders with its roots at a great diſtance from each other; at leaſt it comes nearer to this than to the ſhape of an anvil. It may be divided into a body and branches. The body is a large ſubſtance, the branches or legs are two, one long and one ſhort. The body is turned forward, the ſhort leg backward, and the long leg downward.

409. The body of the incus is broader than it is thick. It has two eminences, and two cavities between them, much in the ſame manner as we ſee in the crown of the firſt grinders.

410. The ſhort leg is thick at its origin, and from thence decreaſing gradually, it ends in a point. It is ſituated horizontally, its point being turned backward, and joined to the edge of the maſtoide opening of the tympanum.

411. The long leg viewed through the external auditory paſſage, appears to be ſituated vertically; but if we look upon it either on the fore or back ſide, we ſee it is inclined, the extremity of it being turned much more inward than the root or origin. The point of the extremity is a little flatted, and bent inward like a hook, and ſometimes a little hollowed like a kind of ear-picker. By this we may diſtinguiſh the incus of one ear from that of the other, when out of their places; for, turning the ſhort leg backward and the long leg downward, if the curvature of this long leg be toward the left hand, the bone belongs to the right ear; if towards the right, it belongs to the left ear.

412. The malleus or hammer is a long bone, with a large head, a ſmall neck, an handle, and two apopyſes, one in the neck, the other in the handle.

Malleus.

413. The top of the head is conſiderably rounded, and from thence it contracts all the way to the neck. Both head and neck are in an inclined ſituation, and the eminences and cavities in it anſwer to thoſe in the body of the incus.

414. The handle is looked upon by ſome, as one of the apophyſes of the malleus: and in that caſe, it is the greateſt of the three. It forms an angle with the neck and head, near which it is ſomething broad and flat, and decreaſes gradually toward its extremity.

415. The apophyſis of the handle, termed by others, the ſmall or ſhort apophyſis of the malleus, terminates the angle already mentioned, being extended towards the neck, and lying in a ſtraight line with that ſide or border of the handle which is next it.

416. The apophyſis of the neck, called alſo *apophyſis gracilis*, is in a natural ſtate very long, but ſo ſlender withal, that it is very eaſily broken, eſpecially when dry; which is the reaſon why the true length of it was for a long time unknown. It ariſes from the neck, and ſometimes appears much longer than it really is, by the addition of a ſmall dried tendon ſticking to it.

417. When the malleus is in its true ſituation, the head

and neck are turned upwards and inwards, the handle downwards, parallel to the long leg of the incus, but more forward; the apophyſis of the handle upwards and outward, near the ſuperior portion of the edge of the tympanum, near the center of which is the extremity of the handle, and the apophyſis gracilis forward, reaching all the way to the articular fiſſure in the Os Temporis. It is eaſy, after what has been ſaid, to diſtinguiſh the malleus of the right ſide from that of the left.

Stapes.

418. The ſtapes is a ſmall bone, very well denominated from the reſemblance it bears to a ſtirrup. It is divided into the head, legs, and baſis.

419. The head is placed upon a ſhort flatted neck, the top of it being ſometimes flat, ſometimes a little hollow.

420. The two legs taken together, form an arch, like that of a ſtirrup, in the concave ſide of which is a groove, which runs through their whole length. One leg is longer, more bent, and a little broader than the other.

421. The baſis reſembles that of a ſtirrup, both in its oval ſhape, and union with the legs, except that it is not perforated as the ſtirrups now are, but ſolid, like thoſe of the ancients. Round its circumference, next the legs, is a little border which makes that ſide of the baſis appear a little hollow. The other ſide is pretty ſmooth, and one half of the circumference is ſomething more curve than the other.

422. The ſubject being in an erect poſture, the ſtapes is to be conſidered as lying on its ſide, with the head turned outward, near the extremity of the leg of the incus; the baſis, inward, being fixed in the feneſtra ovalis; the longeſt leg, backward; the ſhorteſt forward, and both in the ſame plane. By this ſituation, it is eaſy to know the ſtapes belonging to each ear.

Os orbiculare.

423. The orbicular or lenticular bone is the ſmalleſt bone in the body. It lies between the head of the ſtapes and extremity of the long leg of the incus, being articulated with each of theſe. In dry bones it is found very cloſely connected, ſometimes to the ſtapes, ſometimes to the incus; and might in that ſtate be eaſily miſtaken for an epiphyſis of either of theſe bones.

Labyrinth.

424. The labyrinth is divided into three parts, the anterior, middle, and poſterior. The mid-

dle portion is termed *veſtibulum*, the anterior, *cochlea*, and the poſterior, the *labyrinth in particular*, which comprehends the three ſemi-circular canals.

425. It is proper here to call to mind the true ſituation and direction of the apophyſis petroſa. This being ſuppoſed, the cochlea lies forward and inward, towards the extremity of the apophyſis; the ſemicircular canals, backward and outward, toward the baſis of the apophyſis, and the veſtibulum between the other two.

Veſtibulum.

426. The veſtibulum is an irregularly round cavity, leſs than the tympanum, and ſituated more inward and a little more forward. Theſe two cavities are, in a manner, ſet back to back, with a common partition-wall between them, perforated near the middle by the feneſtra ovalis, by which the cavities communicate with one another.

427. The cavity of the veſtibulum is likewiſe perforated by ſeveral other holes; on the outſide or towards the tympanum, by the feneſtra rotunda, but this is commonly ſeen in dry bones only; on the backſide, by the five orifices of the ſemicircular canals; on the lower part of the foreſide, by two holes which are the entry of the cochlea, but one of them is ſhut up in freſh bones; and on the foreſide, towards the internal meatus auditorius, oppoſite to the feneſtra ovalis, by a great many very ſmall holes for the paſſage of the nerves. On the upper ſide there are only ſmall pores.

Semicircular canals.

428. The ſemicircular canals are three in number, one vertical and ſuperior, one vertical and poſterior, and one horizontal. The ſuperior vertical canal is ſituated tranſverſely with reſpect to the apophyſis petroſa, the convex ſide or curvature of it being turned upward, and the extremities downward, one inward, the other outward. The poſterior verticle canal lies parallel to the length of the apophyſis, the curvature being turned backward, and the extremities forward, one upward, the other downward; and the ſuperior extremity of this canal meets and loſes itſelf in the internal extremity of the former. The curvature and extremities of the horizontal canal are almoſt on a level; the curvature lying obliquely backward, and the extremities forward, ending under thoſe of the ſuperior vertical canal, but a little nearer each other;

and the inner being almoſt in the middle ſpace, between the extremities of the poſterior vertical canal.

429. The horizontal canal is generally the leaſt of the three, the poſterior vertical is often, and the ſuperior vertical ſometimes, the greateſt; and ſometimes theſe two are equal. All the three canals are larger than a ſemicircle, forming nearly three quadrants; they are broader at the orifices than in the middle. Theſe orifices open into the backſide of the veſtibulum, as has been ſaid, being but five in number, becauſe two of them are loſt in each other, N° 428; ſo that in the poſterior part of the veſtibulum, two appear towards the inſide, and three towards the outſide.

430. In children, the ſubſtance of theſe canals is compact, while that which ſurrounds them is ſpungy, ſo that they may be eaſily ſeparated from the reſt of the apophyſis petroſa. In adults, all the parts of the bone are ſo ſolid, that theſe canals appear only like paſſages dug in a piece of ivory. From this deſcription it is eaſy to diſtinguiſh the right labyrinth from the left.

431. The cochlea is a ſort of ſpiral ſhell, with two ducts, formed in the anterior part of the apophyſis petroſa, in ſome meaſure reſembling the ſhell of a ſnail. The parts to be diſtinguiſhed in it, in its true ſituation, are the baſis, the apex, the ſpiral lamina or half ſeptum, by which its cavity is divided into two half canals, the ſpindle round which the cochlea turns, and, laſtly, the orifices and union of the two ducts.

Cochlea.

432. The baſis is turned directly inward, toward the internal foramen auditorium, the apex outward, and the axis of the ſpindle is nearly horizontal: but in all of them allowance muſt be made for the obliquity of the Os Petroſum in which they lie.

433. The baſis of the cochlea is gently hollowed, and, towards the middle, perforated by ſeveral ſmall holes. The ſpindle is a kind of ſhort cone, with a very large baſis, which is the middle of the baſis of the cochlea. Through its whole length runs a double ſpiral groove, which, through a microſcope, ſhews a great number of pores.

434. The Cochlea makes about two turns and an half from the baſis to the apex; and the two ducts being ſtrictly united together through their whole courſe, from an entire common

ſeptum, which muſt not be confounded with the half ſeptum or ſpiral lamina, as is often done. The firſt might be termed the *common ſeptum*, the other the *particular ſeptum*, or *half-ſeptum.*

435. Both of them are cloſely joined to the ſpindle, being thicker there than in any other place. The common ſeptum is complete, and ſeparates the turns entirely from each other, whereas the half-ſeptum in the ſkeleton is only a ſpiral lamina, the breadth of which is terminated all round by a very thin border lying in the middle cavity of the cochlea. In the natural ſtate there is a membranous half-ſeptum, which completes the partition between the two ducts, as we ſhall ſee in deſcribing the freſh bones.

436. The two half-canals turn jointly about the ſpindle, one being ſituated towards the baſis of the cochlea, the other towards the apex: for which reaſon I have always termed one of them *internal*, the other *external*; the diviſion of them into the upper and lower flight, not being agreeable to the natural ſtate, but liable to convey a very falſe idea thereof.

437. The ſpiral or volute of the cochlea begins at the lower part of the veſtibulum, runs from thence forward to the top, then backward down to the bottom, afterwards upwards and forward, and ſo on from the baſis which is turned inward, to the apex which is turned outward.

438. From this deſcription it is eaſy to know to what ear any cochlea belongs when we ſee it prepared. It likewiſe teaches us, that in the right cochlea, the direction of the turnings is the ſame as in garden-ſnails, and almoſt all the other common ſhells; but in the left cochlea, the turnings are in a contrary direction, as in one kind of ſhell, which is rarely met with.

439. The two half-canals communicate fully at the apex of the cochlea. Their ſeparate openings are towards the baſis, one of them being immediately into the lower part of the foreſide of the veſtibulum, the other into the feneſtra rotunda. Theſe two openings are ſeparated by a particular turning, which ſhall be explained in deſcribing the organ of hearing.

440. The internal auditory hole is in the backſide of the apophyſis petroſa, in ſome meaſure behind the veſtibulum, and baſis of the cochlea. It is a kind of blind hole, divided into two foſſulæ, one large, the

Foramen auditorium internum.

the other ſmall. The large one lies loweſt, and ſerves for the portio mollis of the auditory nerve or ſeventh pair. The ſmall one is uppermoſt, and is the opening of a ſmall duct, through which the portio dura of the ſame nerve paſſes.

441. The inferior foſſula is full of little holes, which, in the natural ſtate, are filled with nervous filaments of the portio mollis, which go to the ſpindle, to the ſemicircular canals, and to thoſe of the cochlea. It is this foſſula which forms the ſhallow cavity at the baſis of the ſpindle of the cochlea.

442. The paſſage for the portia dura of the auditory nerve runs behind the tympanum, and its orifice is the ſtylo-maſtoide hole. Fallopius gave to this duct the name of *aqueduct* from its reſemblance to ſome aqueducts in Italy. It begins by the ſmall foſſula, and pierces from within outwards, the upper part of the apophyſis petroſa, making there an angle or curvature. From thence it is inclined backward, behind the ſmall pyramid of the tympanum, and runs down to the ſtylo-maſtoide hole, through which it goes out, and is diſtributed in the manner we ſhall ſee in the deſcription of the nerves. It communicates likewiſe by a ſmall hole, with the ſinus of the pyramid, and lower down by another hole with the barrel of the ear.

443. In ſome ſculls this aqueduct of Fallopius is open on the upper part of the apophyſis petroſa, a kind of break appearing in it, formed by a double hole. It is at this place that it makes the angle already mentioned. But commonly it is covered with a bony lamina.

§ 19. *The ſupernumerary bones of the head.*

444. I call by the name of ſupernumerary bones, ſeveral pieces found in ſome ſculls, chiefly between the parietal and occipital bones. They form breaks in the lambdoidal ſuture, and are joined by true ſutures to the bones already mentioned.

445. Their figure, number, and ſizes, vary very much. They are ſometimes in ſome meaſure triangular, but oftener of no regular figure. In ſome ſubjects they incroach on the occipital bone, in others on the parietal bones, and ſometimes they extend themſelves every way. They are commonly indented,

dented, and broader on the outſide of the ſcull than on the inſide, in which they are without any viſible indentations; and ſometimes are ſcarcely to be ſeen, when they are ſmall on the outſide.

446. They have been termed *keys*, a name given by joiners to the pieces which ſerve to ſtrengthen the joints of boards; but which can agree to them only in reſpect to their ſituation, and not in reſpect to their uſes in the cranium or other bones of the head. They may ſerve to multiply the ordinary ſutures, *&c.*

447. Some ſuch bones have likewiſe been found in the joints between the bones of the head and face; and between thoſe of the bones of the face with each other; and to theſe might be added the ſupernumerary teeth placed out of the rank of the reſt.

ART. III.

The bones of the trunk.

448. THE trunk comprehends all the bones, which in a natural ſtate lie between the head and the four great extremities. Theſe bones are divided into three parts, the Spine, Thorax, and Pelvis; the firſt of which, that is, the ſpine, may be looked upon as a common part, the other two as proper.

§ 1. *The Spine and Vertebræ in general.*

Extent and ſituation in general.

449. By the ſpine is meant all that order of bones which follow one another without interruption, from the Os Occipitis, downward, along the poſterior part of the trunk.

Figure.

450. It repreſents a very compound folding pillar, round on the foreſide, and on the backſide ſtuck full of prickles or points, repreſenting ſo many particular ſpines; having a canal in the middle, through its whole length into which a great number of holes open on each ſide. When it is viewed directly on the fore or back ſide, it appears ſtraight and to be made up of different portions of pyramids in a con-

trary ſituation to each other; but viewed ſidewiſe, it preſents ſeveral different curvatures.

451. The pieces which form the ſpine, are of two kinds, one ſingle, the other compound. The ſingle pieces are generally twenty-four in number, called by the name of *Vertebræ*; the compound pieces are two, the Os Sacrum and Os Coccygis; the ſingle pieces are likewiſe called *true vertebræ*, to diſtinguiſh them from the portions which compoſe the other two, which are called *falſe vertebræ*.

Diviſion.

452. The true vertebræ are divided into three claſſes, *viz.* ſeven vertebræ of the neck, twelve of the back, and five of the loins, to which are likewiſe given the names of *cervical*, *dorſal*, and *lumbar vertebræ*.

453. To have a clear idea of the ſtructure and diſpoſition of each vertebra, we muſt firſt examine what they have in common, and next what is peculiar to the vertebræ of each claſs, or to any particular vertebræ therein. Afterwards, the deſcription of the portions which compoſe the Os Sacrum and Os Coccygis, will complete this firſt part of the trunk.

454. What is common to all the vertebræ, may be reduced to their external conformation, internal ſtructure, connection and uſes.

455. In the vertebræ in general, we are to conſider the body, apophyſes, and cavities.

External conformation and diviſion of each vertebra.

455. By the body of the vertebræ, we mean that principal part or large maſs, ſituated anteriorly, and which ſupports all the other parts In moſt of the vertebræ the body repreſents a portion of a cylinder cut tranſverſely, the circumference of which is more or leſs round on the fore-part, and ſloped on the back-part. It has two ſides, the upper and lower, each of which is, as it were, bordered by a thin lamina in form of an epiphyſis.

Body of the vertebræ.

457. The apophyſes in moſt of the vertebræ are ſeven in number: one poſterior, called the *ſpinal apophyſis*, which ends in a ſmall epiphyſis, and has given the name to the whole ſyſtem of the vertebræ; two lateral, called *tranſverſe apophyſes*; and four, which are likewiſe lateral, two on each ſide, one above, and one below. They are called by the general name of *oblique apophyſes*, and diſtinguiſhed into ſuperior or aſcending, and inferior or deſcending. Theſe four

Apophyſes.

are the leaſt of all the proceſſes of the vertebræ, and each of them has a cartilaginous ſide. I ſhould chuſe to call them *articular* rather than *oblique apophyſes*, for a reaſon which ſhall be afterwards given, and I ſometimes name them likewiſe the *ſmall apophyſes* of the vertebræ.

Cavities. 458. The cavities in the vertebræ are theſe; a large middle hole, between the body and apophyſes; four notches, two on each ſide, one ſuperior and ſmall, and one inferior which is larger. The great foramen is part of the vertebral or ſpinal canal, and the notches of one vertebra meeting thoſe in another, form the lateral holes, which communicate with the canal.

Situation in particular. 459. Though the ſituation of the vertebræ has been already mentioned pretty exactly, it will be proper to repeat it again. The body is the anterior part of each vertebra: the ſpinal proceſs, the poſterior part; the tranſverſe and oblique or articular proceſſes are the lateral parts; and the great foramen is in the middle of all theſe parts.

Internal ſtructure. 460. The inner ſubſtance is ſpungy or like a diploë covered with an outer compact ſubſtance, which in the body of the vertebræ is very thin, but thicker in the proceſſes.

Connection. 461. The vertebræ are joined together by their bodies and by their ſmall apophyſes. The bodies in a natural ſtate are principally united by a cartilaginous ſymphyſis, that is, by the intervention of a pliable and elaſtic cartilage, as we ſhall ſee in deſcribing the freſh bones. This cartilaginous connection makes the lateral holes of the ſpine larger in the body than in the ſkeleton, where theſe cartilages are wanting.

462. Their connection by the ſmall apophyſes, is by arthrodia, and not by ginglymus, as ſhall be afterwards ſhewn. Theſe two articulations are ſecured by very ſtrong ligaments, of which in another place.

§ 2. *Vertebræ of the neck.*

The body. 463. In moſt of the vertebræ of the neck, the body is a little flatted anteriorly, and is thinner or ſhorter than that of all the other vertebræ of the ſpine. The upper ſide is a little concave, the lower proportionably convex. The breadth on the forepart increaſes gradually as they deſcend; ſo that taken all together, they repreſent a ſort of pyramid. All that is here ſaid is not to be extended to the two firſt vertebræ, nor to the ſeventh.

Spinal proceſſes.

464. The ſpinal apophyſes are more or leſs ſtraitened, and forked at the extremity, except in the firſt vertebra, which has no ſuch proceſs.

Tranſverſe apophyſes.

465. The tranſverſe apophyſes are for the moſt part very ſhort, perforated perpendicularly, concave or grooved on the upper ſide, a little forked, and as it were, double, except in the firſt and laſt vertebræ, in which theſe apophyſes are longer, and more pointed.

Oblique apophyſes.

466. The articular apophyſes, except the firſt, are more oblique than in the other vertebræ, and their cartilaginous ſides are inclined in ſuch a manner as that, in each vertebra, the ſuperior apophyſes are turned backward and upward; the inferior forward and downward. Some particularities in the two firſt vertebræ are here likewiſe to be excepted.

The firſt vertebra of the neck.

467. The firſt vertebra is called *atlas*, becauſe it ſupports the head, as Atlas did the globe of the univerſe, according to the ancient fable. It is neither body nor ſpinal apophyſis. The hole or opening in it is much larger than in the reſt. It looks like an irregular bony ring filled all round with eminences and cavities. It may be divided into two arches: the anterior or largeſt, and poſterior or ſmalleſt.

468. The anterior arch is formed by two thick lateral portions, and a ſmall curve middle part, which, with the other two, makes a notch in the anterior part of the great cavity of the vertebra. The lateral portions may be looked upon as a body in two parts, without which the firſt vertebra would have been too weak to ſuſtain the articulations.

469. In the middle of the convex ſide of the poſterior arch, is a tubercle a little pointed, larger than the anterior tubercle, and marked with muſcular impreſſions on each ſide, and on the upper and lower edge. This tubercle ſeems to be in the place of a ſpinal apophyſis.

470. The tranſverſe apophyſes of the firſt vertebra ariſe

from the middle of the breadth of the lateral portions, being perforated perpendiculary at their broad origins. They are much longer than thoſe of the five vertebræ below them, and contracting gradually, they terminate in an obtuſe point, which is ſometimes in a manner double, and marked on the upper and lower ſide with muſcular impreſſions.

471. The ſuperior articular apophyſes are larger than any other apophyſes of the ſame kind in the whole ſpine. They are oblong cartilaginous cavities framed in the upper ſide of the lateral portions. Their ſituation is almoſt horizontal, and their anterior extremities are turned more inward, that is, nearer one another than the poſterior. They are, in a word, every way proportioned to the condyles of the Os Occipitis.

472. The inferior articular apophyſes are leſs hollow, ſhorter, and broader. They are inclined laterally from within outwards, and from above downward. They are directly under the ſuperior apophyſes; and thus the articular and tranſverſe apophyſes, the holes and lateral portions on each ſide are all in the ſame line.

473. There is a long notch or kind of groove between each ſuperior articular apophyſis, and the poſterior arch of the bony ring, reaching from the hole in the tranſverſe apophyſis backward: in which notch, the vertebral blood-veſſels in the natural ſtate make a turn, before they enter the great occipital foramen. Sometimes, though very rarely, there is a complete hole in the room of this groove. There is another notch, but more ſhallow, on each ſide, between this arch and the inferior apophyſes.

474. In the internal circumference of the great hole of this vertebra, in the middle of the great notch, is a cartilaginous impreſſion for the articulation of the axis of the ſecond vertebra; and on each ſide of that notch, between the ſuperior and inferior apophyſes, there is another ſmall impreſſion for the inſertion of a tranſverſe ligament, which ſecures the axis in its place. All round this circumference, both towards its upper and lower edges, there are many other inequalities or impreſſions.

Second vertebra.

475. The ſecond vertebra of the neck is very different from the firſt. Its body is narrower and longer than that of the following vertebræ; and

its length is increaſed on the upper part by an eminence like a pivot or axis, called by the Greeks *odontoides*, by the Latins *dentiformis*, or ſimply *dens*.

476. In this axis four impreſſions or marks are obſervable; one anterior which is cartilaginous, for its articulation by a like impreſſion, with the great notch in the firſt vertebra; one poſterior, for the inſertion of the tranſverſe ligament already mentioned; two ſuperior, which unite at the point of the axis, and ſerve for the inſertion of the ligaments by which the axis is faſtened to the anterior edge of the occipital hole. The ſuperior portion of the axis is a true epiphyſis grafted upon a forked apophyſis.

477. The ſpinal apophyſis is ſhort, broad, and very much forked, being diſtinguiſhed into two lateral parts by a kind of angular criſta. The lower ſide of it is hollow, and the cavity is angular, and divided into two lateral parts by a bony line.

478. The tranſverſe apophyſes are very ſhort, a little inclined downward, and perforated obliquely; whereas in all the other vertebræ theſe perforations are perpendicular. When the apophyſes are thin, this obliquity does not appear ſo much; but when they are thick. the hole is more like a true canal, bent in ſuch a manner as that one orifice is downward, the other outward. The apophyſes themſelves end in a point turned downward.

479. The ſuperior articular apophyſes do not anſwer exactly to the inferior apophyſes of the firſt vertebræ. Their cartilaginous ſides are inclined obliquely outward and downward; and as they are narrower than the former, and have their edges more raiſed toward the outſide, a ſmall empty ſpace is commonly left between the two, on the fore and back parts, in the ſkeleton: the reaſon of which appearance ſhall be given in the hiſtory of the freſh bones. The ſuperior apophyſes of this vertebra, the tranſverſe proceſſes of the firſt and their holes are all in the ſame perpendicular line.

480. The inferior apophyſes are leſs, and ſituated further back. Their cartilaginous ſides are turned backward, and very obliquely, inclined from below, upward, and from before, backward; ſo that their ſituation is more vertical than horizontal. They are likewiſe a little hollow.

481. The ſuperior notches are ſuperficial, long, ſituated

behind the ſuperior apophyſes, and inſenſibly diſappear toward the ſpinal apophyſes. The inferior notches are ſituated more forward, directly under the tranſverſe apophyſes, and their holes. The body of this vertebra has a very ſmall tubercle on the fore-ſide.

Third vertebra.

482. The conformation of the third vertebra of the neck is not very different from that of the vertebræ of the neck in general already deſcribed. The ſuperior apophyſes anſwer to the inferior apophyſes of the ſecond vertebra, their cartilaginous ſides being a little convex and turned backward. The inferior apophyſes are a little hollow and turned forward.

483. The tranſverſe apophyſes are very ſhort, and placed before the articular ones. They are ſomething forked and depreſſed on the upper ſide, between the lateral hole and the extremity. The notches are turned a little forward, above and below the tranſverſe apophyſes, and the lower are deeper than the upper.

Fourth, fifth, and ſixth vertebræ.

484. The fourth, fifth, and ſixth vertebræ are like the third, except that their bodies are gradually more extended, but ſtill hollow on the upper ſide, and convex on the lower; and that the ſpinal apophyſis of the ſixth vertebra is longer, thinner, and ſtraighter than in the three above it. The inferior apophyſes of the fourth and fifth vertebræ, and the ſuperior of the ſixth, are not ſo much inclined as thoſe above them.

Seventh vertebra.

485. The body of the laſt vertebra of the neck is the largeſt of all, ſo that, as has been already ſaid, all the ſeven repreſent a ſort of pyramid ſet on the vertebral pillar of the back. The lower ſide of the body of this vertebra is almoſt flat. The ſpinal apophyſis is long, almoſt ſtraight, and very prominent, for which reaſon it has been termed *prominens* in Latin. It ends in a little flat head, ſometimes ſmooth, and ſometimes a little depreſſed or forked.

486. The tranſverſe apophyſes of this vertebra are longer, placed further back, and leſs grooved than the former. Their holes are ſometimes double, and in that caſe, leſs than when they are ſingle: and ſometimes there is a break or opening in them like a notch, which variety is alſo obſervable in the ſixth vertebra.

487. The ſuperior apophyſes are like thoſe of the other vertebræ, but in the inferior, the ſides are more inclined and broader, anſwerably to the ſuperior apophyſes of the firſt vertebra of the back.

488. In the ſix lower vertebræ of the neck, the middle holes are much larger than in the vertebræ of the back. They are in ſome meaſure triangular, being broad on the foreſide, and contracted on the backſide.

§ 3. *Vertebræ of the back.*

489. The bodies of the vertebræ of the back are longer than thoſe of the neck, and in all of them, except the firſt, the upper ſide of which is a little hollow, both upper and lower ſides are equally flat.

490. From the firſt vertebra to the fourth or fifth, their bodies are contracted between the upper and lower ſides gradually more in the lower vertebræ; and in the ſame manner, they grow broader between the fore and back ſides: ſo that when viewed on the fore-ſide, they repreſent an inverted pyramid or cone, but viewed laterally, they repreſent a pyramid in its natural ſituation.

491. From the fourth vertebra to the laſt, the ſize of the bodies gradually increaſes, but more between the upper and lower, than between the fore and back ſides. Therefore when the whole pillar of the dorſal vertebræ is viewed on the foreſide, a ſenſible contraction is perceivable in the upper half of the pillar, which does not appear in a lateral view.

492. The ſpinal apophyſes are long, ſharp on the upper ſide, and a little hollow on the lower, in which there is often a ſmall bony line directly oppoſite to the ſharp edge. They end in a ſort of little pointed head. They are very much inclined downward, except the firſt three or four, which are ſtraighter and ſhorter in proportion to their nearneſs to the vertebræ of the neck. The three laſt grow likewiſe ſtraighter by degrees as they deſcend, and are broader and ſhorter than thoſe above them.

493. The articular apophyſes are ſituated almoſt directly above and below the tranſverſe, and their ſides are rather perpendicular than oblique. The ſides of the ſuperior apophy-

ſes are a little convex and turned backward; the inferior a little concave and turned forward.

494. The tranſverſe apophyſes are pretty long, but their length diminiſhes by degrees all the way to the twelfth vertebra, in which they are both very ſhort and very ſmall. They end in a ſort of head ſet upon a narrow neck. In the anterior part of theſe heads, are cartilaginous cavities anſwering to the tubercles in the ribs. Theſe cavities diminiſh by degrees as they deſcend, and in the two laſt vertebræ there are ſcarce any to be ſeen. In the upper vertebræ they are ſituated more forward than in the following, in which they remove gradually outward.

495. The lateral notches are between the articular apophyſes and bodies of the vertebræ, and the inferior are the moſt hollow.

496. Moſt of theſe vertebræ have four ſmall cartilaginous impreſſions, two on each ſide of their bodies, one at the upper edge, the other at the lower, near the articular apophyſes These impreſſions are obliquely hollow, and diſpoſed in ſuch a manner as that the inferior in the body of one vertebra and the ſuperior in the next below, form a ſort of niche, in which the heads or ends of the ribs are articulated. In the firſt vertebra there is commonly an entire niche for the firſt rib, and half of another for the ſecond. The two laſt vertebræ have generally but one entire niche on each ſide. Theſe marks are peculiar to the vertebræ of the back, and eaſily diſtinguiſh them from the reſt.

497. In the lower articular apophyſes of the laſt vertebra, the ſides are turned laterally from within outward, and are likewiſe a little convex; for which reaſon this vertebra is received both above and below; whereas the firſt vertebra of the neck receives both ways. Beſides the ſeven ordinary apophyſes, this laſt vertebra has often two ſmall ones between the tranſverſe and ſuperior articular apophyſes.

498. The large middle holes in the vertebræ of the back grow rounder and narrower as they deſcend, eſpecially from the firſt to the tenth, where they begin again to be more flat and more extended, nearly in the ſame manner as in the two firſt.

499. All theſe large holes, each of which ought to be looked upon as a portion of a canal, have a notch in the back-ſide

back-ſide above the ſpinal proceſſes, and between the articular apophyſes. In moſt of the vertebræ of the neck, we meet likewiſe with large notches or ſlops, above the ſpinal apophyſes; but as they are very broad and ſhallow, they are but little regarded. In the laſt vertebra of the neck this notch is remarkable enough, and that in the laſt vertebra of the back appears to be deeper than any of the reſt.

§ 4. *Vertebræ of the loins.*

500. The bodies of the vertebræ of the loins are the largeſt in the whole ſpine, and as they deſcend they increaſe, though much more in breadth than in thickneſs; that is, more between the upper and lower ſides than between the back and fore ſides. Between the upper and lower ſides they are a little contracted in the middle, and their edges are conſequently prominent.

501. The ſpinal apophyſes are ſhort, ſtrait, and broad on each ſide, but narrow on the upper and lower parts. The upper edge is ſharp; the lower divided as it were into two labia by a narrow ridge more or leſs prominent. The extremities ſwell a little, and the ſpinal apophyſis of the fifth vertebra is ſhorter and narrower than the reſt, and bent a little downward.

502. The tranſverſe apophyſes are longer and more ſlender than in the vertebræ of the back; they increaſe in length from the firſt to the third, and then diminiſh to the fifth. They are flat on the back part, and more even on the fore part.

503. The ſuperior articular apophyſes of all theſe vertebræ are hollowed lengthwiſe; the inferior are convex lengthwiſe, and placed nearer each other than the ſuperior. The cavities are turned inward or toward each other, the convexities outward and from each other; ſo that they are ſituated in two different planes more or leſs parallel to the planes of the ſpinal apophyſes.

504. This direction changes by ſmall degrees as the vertebræ deſcend; and thus in the fifth vertebra the ſides of the inferior apophyſes are turned a little more forward.

505. Beſides theſe ſeven apophyſes, each vertebra has two additional ones near the ſuperior apophyſes. The lower ſide

of the body of the laſt vertebra is obliquely inclined forward, ſo that it is much longer before than behind.

506. The great foramina in theſe vertebræ are larger than in thoſe of the back. They are flatted on the foreſide, and almoſt angular behind, much in the ſame manner as in the vertebræ of the neck.

§ 5. *Os Sacrum.*

Situation in general. 507. The Os Sacrum is ſituated in the poſterior and lower part of the trunk, as the baſis by which the whole ſpine is ſupported, and from hence it has by ſome been termed *Os Baſilare.*

Figure, and diviſion. 508. Its figure comes near that of a long triangle with the baſis upward, and the apex downward. It may be divided into the upper part of the baſis; the lower part or apex; two ſides, the anterior or concave, and the poſterior or convex; and two lateral parts or edges. We here conſider it as one bone only, as it is in an adult ſubject.

509. In young ſubjects it is made up of ſeveral diſtinct pieces termed *falſe vertebræ,* united together by cartilages, which in time diminiſh, grow hard, and diſappear, leaving no marks behind them but little ridges or lines more or leſs prominent. Theſe pieces are five in number, and ſometimes ſix, all of them reſembling the vertebræ in ſomething. The firſt is much larger than any of the true vertebræ; but their ſize diminiſhes by very great degrees as they deſcend, ſo that the loweſt which makes the point of the Os Sacrum, has ſcarcely the appearance of a vertebra.

Anterior ſide. 510. In the anterior or concave ſide, we ſee commonly four pair of large holes, and ſometimes more, (according to the number of falſe vertebræ) diſpoſed in two longitudinal rows, and appearing to be formed by the notches in the original pieces meeting each other. Between theſe two rows of holes, through the whole length of the middle of this ſide, we obſerve the bodies of five or ſix falſe vertebræ cemented together, of which the uppermoſt or firſt comes nearer to the ſtructure of a true vertebra than the reſt. The laſt is very ſmall, and below the holes, it has a notch on each ſide, and ſometimes a production in ſhape of a little horn.

511. The poſterior or convex ſide is very uneven. The ſame number of holes appear here, as in the fore ſide, and diſpoſed in the ſame order, but they are not ſo large. Between the two rows of holes, is a ſort of ſpinal apophyſis more or leſs imperfect, eſpecially toward the upper part. In theſe apophyſes we often find openings, ſometimes in the ſuperior, ſometimes in the inferior; and thus perpendicular fiſſures are formed of different breadths. Sometimes a tranſverſe opening is left between the ſeveral ſpines; but in all that has been here ſaid, great varieties are obſervable. On the outſide of each row of holes are tuberoſities which appear like tranſverſe and articular apophyſes confounded together.

Poſterior ſide.

512. At the baſis or upper part of the Os Sacrum are two true articular apophyſes anſwering to the inferior ones of the laſt vertebra of the loins. Below each of theſe apophyſes, laterally, is a large notch; and between them we ſee diſtincly enough the upper ſide of the body of the firſt falſe vertebra, which is like that of the lumber vertebræ, being very much inclined backward; ſo that the body of this falſe vertebra, as well as of the laſt true one, is longer before than behind. From this obliquity it happens, that the Os Sacrum and laſt lumber vertebra form at their connection a very conſiderable angle.

513. Behind the body of this firſt vertebra of the Os Sacrum, between the articular apophyſes, lies the orifice of a large canal, triangular and flat, which runs down in the middle ſubſtance of the bones between the two ſides, and between the four rows of holes, behind the bodies of all the falſe vertebræ. It contracts as it deſcends, and communicates with all the large holes, being the continuation of the great canal of the ſpine. It is often broke into by the fiſſures already mentioned, on the backſide.

514. The lateral parts are broad toward the top, forming on each hand a large, uneven, irregular cartilaginous ſurface in the figure of a great S, and ſometimes of a bird's head. By theſe two ſides the Os Sacrum is connected with the Oſſa Innominata by a cartilaginous ſymphyſis. Between each of theſe lateral ſides and the

Lateral parts.

neareſt poſterior holes, there is a large rough depreſſion, and under that another not ſo large. Theſe depreſſions are often peirced by ſeveral holes, which loſe themſelves in the inner ſubſtance of the bone.

§ 6. *Os Coccygis.*

551. The Os Coccygis, ſituated at the extremity of the Os Sacrum, is in ſome meaſure an appendix thereof. The figure of it is ſomething like that of an inverted pyramid, a little bent forward toward the pelvis, or like a cuckoo's bill. The anterior ſide is flat, the poſterior a little convex. It is made up of four or five pieces, like falſe vertebræ, joined together by cartilages more or leſs pliable. Sometimes all the pieces are entirely cemented together.

516. The firſt piece is the largeſt, and on each ſide of its baſis there are ſometimes ſmall apophyſes or cornua, joined cloſely to the extremity of the Os Sacrum. It has alſo ſometimes a kind of tranſverſe apophyſes, with ſmall notches on their upper part, which joining with thoſe in the laſt piece of the Os Sacrum form a pair of holes, ſituated in the ſame row with the other large ones. The other pieces of the Os Coccygis are a kind of irregular ſquares, diminiſhing in ſize as they deſcend, ſo that the loweſt is like a ſeſamoide bone.

§ 7. *Uſes and mechaniſm of the ſpine.*

517. The ſpine taken together is the ſupport of all the other bones, and the univerſal director of all the attitudes neceſſary for their different motions. To give a machine both theſe advantages, it muſt have two properties, which at firſt ſight, appear incompatible, *viz.* ſtrength and flexibility or pliableneſs: and it will ſtill be more perfect, if it be withal very light in proportion to its bulk.

518. The author of nature has framed the ſpine, with all theſe advantages, in a manner which is the more wonderful, becauſe it is moſt ſimple. He has made the ſpine flexible, by the number of pieces of which it is compoſed: he has made it firm and ſtrong by diſpoſing theſe pieces, ſo as naturally to ſupport and ſuſtain each other, and by framing them in the moſt convenient manner for that infinite number of cords by

which they are bound together; and laſtly, their internal ſtructure renders them very light.

519. The contrivance of this excellent mechaniſm is not the ſame in all the three claſſes of the vertebræ. Thoſe of the back and loins ſuſtain each other eaſily enough by the extent and direction of their bodies: and in all of them this diſpoſition is proportioned to the weight they have to bear, the inferior vertebræ being larger than thoſe above them.

520 The contraction of this bony pillar, at the fourth or fifth vertebra of the back, does not in the leaſt impair this mechaniſm: for it being at that place in a particular manner ſtrengthened by the connection of the true ribs, large vertebræ would there have been uſeleſs; whereas, by diminiſhing their ſize, the capacity of the thorax is increaſed, for the more commodious reception of the viſcera hereafter to be deſcribed.

521. In the vertebræ of the neck the caſe is different; their bodies are but of a ſmall extent, and the ſides of them narrow. The ſituation of the whole row of theſe vertebræ is oblique and inclined forward, except the two firſt, which are placed perpendicularly; ſo that this portion of the bony pillar is concave, the upper half of it being bent forward.

522. To be able to judge how far this obliquity extends in a living body; we need only either ſtand or ſit, holding our head in a ſtraight poſture, that is, turned neither to one ſide nor the other, and then obſerve the ſituation of the maſtoide apophyſes; becauſe the articulation of the firſt vertebra of the neck with the condyles of the Os Occipitis, is exactly between the anterior edges of theſe apophyſes.

523. When a man ſtands or ſits in an erect poſture, the oblique diſpoſition of theſe vertebræ puts the oblique ſides of their articular apophyſes almoſt in an horizontal ſituation; ſo that they ſupport each other, not only by their bodies, as in the other vertebræ, but alſo by their articular apophyſes, the bodies being thus eaſed of part of their burden.

524. The obliquity of theſe apophyſes appears particularly to facilitate the rotation of the neck, or that motion by which it is turned round, as upon an axis; for the natural oblique ſituation of the neck would have made that motion very difficult without the obliquity of the apophyſes already mentioned. The diſpoſition of the ſecond and third vertebra being

more vertical than oblique, the lateral inflections of the neck are thereby made more eaſy.

525. The holes in the tranſverſe apophyſes of the vertebræ of the neck, form a ſort of canal for the paſſage of the blood-veſſels. The length of this apophyſis in the firſt vertebra enables it to turn more eaſily on the axis of the ſecond; and the ſhortneſs of theſe apophyſes in the other vertebræ, prevents them from injuring the neighbouring parts in the lateral inflections of the neck.

526. The length of the ſpinal apophyſis of the ſecond vertebra facilitates the rotation of the firſt. The ſmallneſs of this apophyſis in the three following vertebræ, prevents them from compreſſing the neighbouring parts, when the neck is bent backwards; and they are broad and forked, to afford ſufficient room for the inſertion of muſcles.

527. The vertebræ of the back ſerve principally for the formation of the cavity of the thorax, by ſuſtaining the arches of the ribs; and this cavity is augmented by this, that the whole row of theſe vertebræ is concave on the fore-ſide.

528. The length of their ſpinal apophyſes is proportioned to the great number of muſcles inſerted in them. The oblique ſituation of theſe apophyſes, and their lying for the moſt part cloſe on one another, not only prevents the inconveniencies of ſo great a length; but hinders the vertebræ from being bent backward, and conſequently enables them to ſupport great weights without ſinking under them.

529. The curvature of the tranſverſe apophyſes backward, enlarges the capacity of the thorax, and gives to the double articulation of the ribs a peculiar ſort of obliquity, without which it is impoſſible to conceive how, by ſimply raiſing the ribs, all the dimenſions of the thorax ſhould be increaſed, and diminiſhed by lowering them.

530. The articular apophyſes of the back being almoſt vertical, and nearly in the ſame plane, ſmall degrees of flexion and extenſion are thereby made practicable, as alſo lateral inflections; but they cannot allow of any rotation. As theſe apophyſes are placed between the tranſverſe, and near the poſterior extremities of the ribs; they are very little expoſed to ſtrains or external injuries, and thereby their ſmall ſize, when compared with the bodies of the dorſal vertebræ, becomes ſufficient.

531. The gentle curvature of the row of lumber vertebræ counterbalances the different directions of the other portions of the ſpine. The ſhortneſs and ſtraitneſs of their ſpinal apophyſes gives room to bend the whole ſpine backward on the loins; and their largeneſs affords ſufficient place for the inſertion of muſcles. The length of their tranſverſe apophyſes, facilitates the action of the muſcles; but the ſhortneſs of the upper and lower apophyſes, prevents their ſtriking againſt the ribs, or Oſſa Innominata, in lateral inflections.

532. The ſize of the articular apophyſes is proportioned to the great efforts which they often ſuffer in their motions. The particular direction of theſe apophyſes ſets bounds to the motions of rotation, by their meeting and ſtriking againſt each other; and it is principally on this occaſion that their large ſize becomes neceſſary, to enable them to ſuſtain ſuch ſtrokes without breaking.

533. The uſe of the Os Sacrum is to ſuſtain the ſpine with all that belongs to it; but in order to this, it was neceſſary that it ſhould be ſtrongly connected with, and incloſed by the Oſſa Innominata, with which it likewiſe ſerves to form the pelvis; the poſterior part thereof belonging to this bone. Its lower extremity is turned very far backward, and thereby the lower part of the pelvis is enlarged. Its appendix, the Os Coccygis, ſerves chiefly to ſupport the inteſtinum rectum and anus, as ſhall be ſaid in another place.

534. Laſtly, the whole canal of the ſpine, from the firſt vertebra of the neck, to the extremity of the Os Sacrum, may be looked upon as an articulated elongation of the cranium, ſerving to contain a production of the brain called the *ſpinal marrow*. This canal is larger in the neck and loins than in the back. The lateral holes formed by the notches in each vertebræ tranſmit the ſame number of nerves.

§ 8. *The bones of the thorax; and firſt, the ribs.*

535. The thorax called commonly the *breaſt*, is the firſt and ſuperior proper part of the trunk. It may be compared to a ſort of cradle, being compoſed of ſeveral lateral pieces, termed *ribs*, and of one anterior piece, called *ſternum*, which, with the twelve vertebræ of the back, form the bony cavity of the breaſt.

Figure and general ſituation of the ribs.

536. The ribs are bony arches of different ſizes, ſituated tranſverſely and obliquely on each ſide of the thorax, and ſo diſpoſed, as that their extremities are turned toward each other.

Number and Differences.

537. They are commonly twenty four in number, twelve on each ſide. This number varies ſometimes on one ſide only, ſometimes in both. They are diſtinguiſhed into true and falſe.

538. The ſeven upper ribs on each ſide go to the ſternum and thus form entire arches; for which reaſon they are named *true ribs*. The five inferior ribs do not reach the ſternum, and becauſe they do not form entire arches, they are termed *falſe ribs*.

Diviſion.

539. In each rib we may conſider in general, the middle part or body; two extremities, one anterior the other poſterior; two ſides, one external and convex, the other internal and concave; two edges, one ſuperior, the other inferior; and two labia in each edge, one external, the other internal. The poſterior extremity, which may be called *the head of the rib*, is articulated with the vertebræ of the back. At the anterior extremity, freſh ribs are lengthened out by cartilaginous epiphyſes, ſtuck into their bony ends. This production is termed the *cartilage* or *cartilaginous portion of the rib.*

540. Each of the true ribs, at the poſterior extremity, hath two ſmall cartilaginous impreſſions, diſtinguiſhed by a kind of angle, by which they are articulated with the lateral cartilaginous impreſſions in the bodies of two vertebræ of the back: but the firſt rib has no more than one ſuch impreſſion, being articulated with one vertebræ only.

541. At a ſmall diſtance from the head of this extremity, poſteriorly, is another cartilaginous impreſſion on each ſide, a little convex and cloſely joined to a ſmall tuberoſity. By theſe the ribs are articulated with the cartilaginous depreſſions in the tranſverſe apophyſes of the dorſal vertebræ; and the tuberoſities ſerve for the inſertion of ligaments. The portion which lies between the head and theſe impreſſions, is contracted, and repreſents a neck.

542. When the poſterior extremity of a rib is articulated

with two vertebræ, the ſecond articulation is always with the tranſverſe proceſs of the loweſt of the two.

543. Between the tuberoſity and middle part of the ribs, there is on the outſide of moſt of them, a kind of oblique rough angle of different breadths. In the firſt rib this angle is not diſtinct from the tuberoſity. In the ſecond, it reaches but to a ſmall diſtance from it. In the third rib, this diſtance is greater, and from thence continues to increaſe gradually all the way to the third falſe rib; ſo that if we look directly at the back of a ſkeleton, theſe angles ſeem to repreſent the two legs of a pair of compaſſes opened pretty wide.

544. On the inſide of the ribs towards the lower edge, we obſerve a groove reaching from the angle, all the way to the extremity, and that chiefly in the five lower true ribs, and the firſt three falſe ones. The upper edge of the two firſt ribs is ſharp; the lower a little rounded. The upper edge of the third is more obtuſe, and the lower more flat. In the reſt, the upper edge is ſomething rounded, and the lower more or leſs ſharp.

545. Theſe ribs increaſe in length as they deſcend, and their anterior extremities on each ſide are at a greater diſtance from one another; ſo that all the extremities of one ſide, with the extremities of the other, repreſent on the forepart of the breaſt, an angle almoſt like that which I already took notice of on the backpart. The extremities of the firſt ribs on each ſide do not lie in the ſame line with the reſt, but, being much ſhorter, are ſituated further back. The ſame thing is ſometimes, though very rarely, obſervable in the two ſecond ribs. There is this likewiſe peculiar to the firſt rib, that its breadth increaſes from behind, forward.

546. In all the ribs the anterior extremity is lower than the poſterior. The firſt is but little inclined, the ſecond more, and the inclination of all the reſt increaſes as they deſcend; their anterior extremities being proportionably at a greater diſtance from each other than the poſterior, the ſpaces between which are every where nearly the ſame.

547. The ribs are much more crooked in the back than in the forepart. The curvature of the two firſt ribs on each ſide, lies almoſt in the ſame plane with the two extremities of each. This equality begins to be loſt in the third rib, which

is ſomething contorted from the angle all the way to the anterior extremity, the lower edge being turned a little outward, and the curvature being turned a little upward, about the middle of the arch, and afterwards a little more downward, from thence to the anterior extremity. This contorſion increaſes in the following ribs, all the way to the third falſe rib; all which look like a contorted Italic *ſ*, and when laid on an even table, one extremity is always turned upward, the other downward.

548. The appendices, epiphyſes, or cartilaginous portions of the true ribs increaſe in length, as they deſcend, in the ſame manner as the ribs themſelves. Each of them, except the firſt, terminates by two little cartilaginous ſides joined together by an angle, by which they are articulated with the ſternum. The extremity of the firſt cartilage is very broad, and cemented to the ſternum by a ſymphyſis, like that by which the other end is connected with the bony extremity of the rib.

549. The cartilages of the firſt three or four ribs lie nearly in the ſame direction with the ribs themſelves. In the ribs below theſe the cartilages make angles, at which they turn upward toward the ſternum, and this curvature increaſes in proportion as the ribs deſcend. The loweſt cartilages, in changing their direction upwards, lie very cloſe to each other, and thoſe of the laſt two true ribs have often at their inferior edge a ſort of apophyſes or production, by which they are connected with the cartilages immediately below them.

550. The laſt two true ribs extend conſiderably in breadth towards their lower ſharp edges, from the angle for a good diſtance anteriorly. Afterwards they contract in breadth and increaſe in thickneſs, forming a ſort of neck a little longer than that at their poſterior extremity; then their breadth begins to increaſe again by degrees all the way to the anterior extremity. In all the ribs, this extremity terminates in a cavity in which the cartilages are grafted.

551. The three uppermoſt falſe ribs increaſe in breadth from the angle forward, in the ſame manner as already ſaid. The grooves are in them moſt conſiderable. They have heads, necks, tuberoſities, and angles, almoſt the ſame as in the laſt true ribs. Their length diminiſhes by degrees and their anterior extremities ſeparating from each other in the

ſame manner with thoſe of the true ribs, lie in the ſame line with them. The laſt two have only one impreſſion at their poſterior extremities, and are without any tuberoſity. They are both much ſhorter than the reſt, eſpecially the fifth.

552. All the falſe ribs have cartilaginous appendices. The firſt is longeſt, and fixed to the cartilage of the laſt true rib. The two following are united together at their extremities. The laſt two are connected only to muſcles and ligaments. They are both very ſhort, eſpecially the laſt, which is not above a quarter of an inch in length. All theſe cartilages of the falſe ribs are pointed at their extremities.

Connection.

553. The ribs are articulated anteriorly with the ſternum, and behind with the vertebræ of the back. The firſt rib is entirely united with the ſternum, by means of its cartilage. In the ſix following, the extremities of the cartilages join that bone.

554. The three upper falſe ribs are joined to each other by the extremities of their cartilages; and the firſt is likewiſe joined to that of the laſt true rib. The two laſt have no ſuch connection, as has been already ſaid.

455. The connection of the ribs with the vertebræ of the back is for the moſt part by a ginglymus. The firſt rib on each ſide is articulated by its head, with the lateral impreſſion in the body of the firſt vertebra, and by its tuberoſity, with the ſmall cavity in the tranſverſe apophyſis of the ſame vertebra.

556. The head of the ſecond rib is articulated by its head with the impreſſions in the lower part of the body of the firſt vertebra, and in the upper part of the body of the ſecond; and by its tuberoſity, with the articular cavity in the tranſverſe apophyſis of the ſecond vertebra.

557. All the other ribs, except the two laſt of the falſe ribs, are articulated in the ſame manner; that is, by their heads, with the impreſſions on the bodies of two vertebræ next each other, and by their tuberoſities, with the tranſverſe apophyſis of the loweſt of each two vertebræ. The eleventh and twelfth ribs are commonly articulated by their heads only, with the impreſſion in the body of one vertebra.

558. From what has been ſaid, it is evident, that the ten upper ribs are confined to two motions, one upward, the o-

ther downward; whereas the two laſt are left more at liberty, and are therefore termed *floating ribs.*

559. The ribs joined to the vertebræ of the back and ſternum form a cavity, capable of expanſion and contraction, in which are contained chiefly the organs of reſpiration, and thoſe of the circulation of the blood. The mechaniſm of their ſtructure ſhall be ſpoken to hereafter.

Uſes.

§ 9. *The Sternum.*

Situation in general.

560. The ſternum is ſituated lengthwiſe in the anterior part of the thorax.

Figure.

561. It is a long flat bone, not all of the ſame breadth, repreſenting a ſort of dagger.

Diviſion.

562. It is generally made up of three principal pieces, the firſt broad and ſhort; the ſecond longer and narrower; the third a ſort of ſmall appendix, called by the Greeks *Xiphoides*, from its reſemblance to the breaſt of a broad-ſword.

The firſt piece.

563. The firſt or uppermoſt piece is broad and thick at the top, but thinner and narrower below, being nearly of the figure of a triangle with the three angles cut off, or of an irregular ſquare. We diſtinguiſh in it two ſides, one external or anterior, the other internal or poſterior; four edges, one ſuperior, two lateral, and one inferior; and four imperfect angles, two ſuperior, and two inferior.

564. The anterior or outſide is unequally convex, the poſterior or inner ſide a little concave.

565. The upper edge is the thickeſt, with a large ſmooth notch or ſlope in the middle, called by the ancients *the furca.* The two ſuperior angles are two large thick articular notches, ſituated obliquely on each ſide of the furca. The lateral edges are thin and oblique, and in each of them we ſee an oblong cartilaginous mark, which belongs to the cartilage of the firſt true rib. The two inferior angles are two articular half-notches, which receive the cartilage of the ſecond rib. The lower edge is ſmaller and thicker than the others, being joined by ſymphyſis to the ſecond piece.

566. The ſecond piece of the ſternum is much longer

than the firſt. It is flat on both ſides, and broader towards the lower than towards the upper part. We obſerve in it ſometimes, eſpecially on the fore-ſide, ſeveral tranſverſe lines, which point out the places where the pieces of which it is made up in children are united together. Both ſides are are flat, but depreſſed more or leſs through the middle of their whole length. The upper edge is ſmall, being proportioned to the lower edge of the firſt piece with which it is connected by a cartilaginous ſymphyſis. The lower edge is ſtill ſmaller, appearing like a truncated angle.

The ſecond piece.

567. The two lateral or greateſt edges have each a cartilaginous half-notch, and five cartilaginous entire notches. The half-notches are at the upper part of the lateral edges, where they meet the half-notches in the firſt piece. The five entire notches come nearer to each other in proportion as they are lower, and part of the laſt belongs often to the third piece.

The third piece.

568. The third piece, called commonly *cartilago xiphoides*, or *enſiformis*, and in French by a word which ſignifies the briſket, is entirely cartilaginous in young ſubjects; but in an advanced age it generally oſſifies either wholly or in part; in ſome ſubjects later than in others; it would therefore be more properly named *appendix xiphoides* or *enſiformis*.

569. This piece is joined to the lower extremity of the ſecond, between the cartilages of the laſt true ribs; and it is often more or leſs notched on each ſide, to form part of the laſt articular notches of the ſternum. Its figure is nearly that of the point of a broad ſword, from whence it has its name both in Greek and Latin; but neither its figure nor ſize are conſtant. In ſome ſubjects it is forked, in ſome perforated. Sometimes it is very large, ſometimes very ſmall, hardly exceeding the third part of an inch.

Subſtance.

570. The inner ſubſtance of the ſternum is almoſt all cellulous and very ſlender, and covered on the outſide with a thin compact lamina.

Uſes.

571. The ſternum completes the fore-part of the cavity of the thorax, and ſuſtains the anterior extremities of the ribs, being ſufficiently fixed to reſiſt compreſſions, and other outward accidents; and yet moveable enough by means of its articulation with the cartilages of the ribs, not to obſtruct the motions neceſſary for reſpiration.

It likewiſe ſerves for the inſertion of ſeveral muſcles, and to ſupport the mediaſtinum, *&c.*

§ 10. *The bones of the Pelvis; and firſt, the Oſſa Ilium.*

Situation of the pelvis in general. 572. The pelvis is the third and loweſt part of the trunk, conſiſting chiefly of two large pieces, called *Oſſa Innominata*, which being united anteriorly by a cartilaginous ſymphyſis, and poſteriorly to the two ſides of the Os Sacrum, repreſent a kind of baſon. When conſidered ſeparately, they have no regular figure, being of different breadths in different parts, unequally convex on the outſide, and unequally concave on the inſide.

573. Each bone is but one piece in adult ſubjects, but in children it conſiſts of three pieces, joined together by a cartilage, which afterwards perfectly oſſifies, leaving commonly no veſtige of the firſt diviſion. Anatomiſts, however, conſider in it, even in adults, three different portions, and diſtinguiſh them by different names, as if they were three diſtinct bones. *General diviſion.*

574. Of theſe three portions, the largeſt is ſuperior and poſterior, called *Os Ilium*; the ſecond, inferior, called *Os Iſchium*; and the third and ſmalleſt, anterior, called *Os Pubis.*

575. Before we treat of each of theſe portions ſeparately, it muſt be obſerved, that in the entire bone, there are ſeveral common parts, or which belong to more portions than one, *viz.* a deep cartilaginous cotyloide cavity, called in Latin *Acetabulum*; formed by all the three portions: a large opening, called *foramen ovale*, formed by the Os Iſchium and Os Pubis: a large poſterior notch or ſinus, called the *iſchiatic notch*, formed by the Os Ilium and Os Iſchium: an oblique eminence or protuberance above the acetabulum towards the foramen ovale, made by the Os Ilium and Os Pubis. To theſe may be added a ridge on the inſide of the pelvis, which divides the upper wide part from the bottom, to which alone the ancients gave the name of *pelvis.*

576. The Os Ilium was ſo named by the ancients, becauſe it ſupports the parts called by them *Ilia.*

Size and figure of the Os Ilium. 577. This bone is the largeſt of the three. It is flat, very broad, unequally convex and concave, partly round and partly of an irregular ſquare figure.

478. It

578. It is divided commodiouſly enough into the criſta, baſis, anterior and poſterior edge, and two ſides, one external, the other internal. *Diviſion.*

579. The criſta is the upper part, being a pretty thick arched border, the circumference of which is a little more than a quadrant of a circle. The anterior and middle part is convex outward, the poſterior part a little convex inward. We diſtinguiſh in it two labia, and a middle ſpace or interſtice between them. It is originally an epiphyſis, of which we ſometimes ſee plain marks in a very advanced age.

580. The poſterior portion of the criſta, which is convex inward, is much thicker than the anterior, and for that reaſon might be called the *tuberculum of the criſta.* The whole criſta appears to be cruſted over with a cartilage, which in reality is no more than the dried tendinous inſertions of the muſcles.

581. The anterior edge of the Os Ilium has two eminences or tubercles, called *the anterior ſpines*; one ſuperior, the other inferior; and likewiſe two notches, one between the ſpines, the other below the inferior ſpine.

582. The poſterior edge is ſhorter and thicker than the anterior. It terminates likewiſe in two eminences or ſpines, between which there is a conſiderable notch.

583. The baſis or inferior part of this bone is the thickeſt and narroweſt of all. It forms anteriorly a portion of the acetabulum, and poſteriorly, almoſt all the iſchiatic ſinus.

584. The outſide is convex on the fore-part, and concave on the back-part. We obſerve on it the remains of a long ſemicircular line which reaches from the upper anterior ſpine, to the great iſchiatic ſinus, being a muſcular mark. Above and behind this ſemicircle there are ſeveral other impreſſions and muſcular marks. A little above the edge of the acetabulum we ſee likewiſe many inequalities which ſurround part of that edge in a ſemicircular form, being a collection of muſcular and ligamentary marks.

585. The inſide is unequally concave, and has ſeveral inequalities toward the back-part, the chief of which is, that large cartilaginous ſurface of the figure of an S, or of a bird's head, which anſwers to the lateral ſurface of the Os Sacrum, with which it is connected by a cartilaginous ſymphyſis. The other inequalities are much of the ſame kind

with thoſe in the lateral part of the Os Sacrum, with which they form ſeveral rough and irregular cavities. From the upper part of the cartilaginous ſurface or ſymphyſis, all the way to the oblique eminence, runs a prominent line which bounds the concavity of the inſide of this bone, and diſtinguiſhes the margin of the pelvis from the bottom.

§ 11. *Oſſa Iſchium.*

Situation in general and diviſion. 586. The Os Iſchium is the loweſt portion of the Os Innominatum, as well as of the whole trunk. It is divided into the body tuberoſity, and ramus or branch.

587. The body of the Os Iſchium forms the loweſt and greateſt part of the acetabulum, and ſends out an apophyſis backward, called *the ſpine of the iſchium.*

588. The tuberoſity is very thick, unequal, and turned downward; and it is on this part that the whole body reſts, when we ſit. It appears cartilaginous, becauſe of the dried and hardened remains of the tendons. The whole convex portion of it is originally an epiphyſis, of which the marks are obliterated ſooner in ſome ſubjects than in others. Three muſcular impreſſions may be diſtinguiſhed in it.

589. The branch of the iſchium is a kind of ſmall, flat, thin production or apophyſis, which aſcends forward from the curvature of the tuberoſity to the Os Pubis; and it is often covered in part by a continuation of the epiphyſes of the tuberoſity.

590. Theſe three parts of the iſchium taken together form a large opening, which makes the greateſt part of the foramen ovale. Three other notches are remarkable upon this bone: one poſterior between the tuberoſity and the ſpine, for the paſſage of the internal obturator muſcle, which is a little cartilaginous, and divided into three or four ſmall ſuperficial channels; one lateral between the tuberoſity and the acetabulum, for the paſſage of the external obturator muſcle: and one anterior at the edge of the acetabulum, for ligaments, *&c.*

§ 12. *Oſſa*

§ 12. *Oſſa Pubis, and Acetabulum.*

Situation in general and diviſion.

591. The Os Pubis is the leaſt of the three portions of the Os Innominatum. The two together form the fore-part of the pelvis; and in each we may diſtinguiſh the body, angle, and branch.

592. The body of the Os Pubis is its upper part, ſituated tranſverſely before the inferior part of the Os Ilium. Its poſterior extremity is very thick, and by its union with the Os Ilium forms the oblique eminence which diſtinguiſhes theſe two portions of the Oſſa Innominata. It likewiſe contributes to the formation of the cotyloide cavity. Its anterior extremity ends in a ſmall eminence or tuberoſity, called *the ſpine of the Os Pubis*, which is ſometimes double.

593. The upper edge has on its inner part an oblique ridge, which may be called *the criſta of the Os Pubis*, and is continuous with that ridge which diſtinguiſhes the margin and bottom of the pelvis. Before this criſta is a broad oblong oblique ſlope. The lower edge is obliquely notched, and forms the upper part of the foramen ovale.

594. The Angle of the Os Pubis is its anterior portion, and makes part of that connection, called *the ſymphyſis of the Oſſa Pubis*. This portion is flat, and not very thick; and in ſome ſubjects, toward the upper part of the foreſide, near the angular curvature, it has an eminence which increaſes the ſize and extent of the ſpine already mentioned. The two Oſſa Pubis, connected together by this portion, form on the foreſide an unequal convexity, but on the backſide a pretty even concavity.

595. The branch of the Os Pubis is a flat thin apophyſis, which, running downward, unites with the branch of the iſchium by a cartilaginous ſymphyſis, of which only ſome marks remain in adults. It completes the formation of the foramen ovale. The branches of the two Oſſa Pubis form on the foreſide a pointed arch, which in the natural ſtate is much more round.

Acetabulum.

596. Beſides what has been ſaid of the acetabulum in general, there are other particulars obſervable about it, which could not well be mentioned till after the deſcription of the three portions of which it is

made up. Theſe are the edge called *ſupercilium*, the cartilaginous cavity, the impreſſion at the bottom of the cavity, and the notch in the edge.

597. The edge or ſupercilium is very prominent on the upper part; on the ſides this prominence decreaſes as they deſcend, and between the anterior and inferior part it is quite loſt. In the natural ſtate it is increaſed by an additional elaſtic circle, which ſhall be deſcribed in the treatiſe of freſh bones.

598. The cavity is proportionable to the prominence of the edge, and conſequently deeper on the upper and back part than on the lower and fore part. It is covered with a very ſmooth cartilage, except from the middle to the notch.

599. This portion of the cavity which is without cartilage, is what I called *the unequal impreſſion*, which is broader toward the bottom of the cavity than toward the edge, and ſerves to contain a ligament and a bundle of glands.

600. The notch is preciſely between the anterior and inferior portion of the edge of the cavity, near the foramen ovale, which it in a manner unites with the cavity. The ſituation of this notch is oblique with reſpect to the direction of the whole body in an erect poſture.

Subſtance of the Os Innominatum.

601. The ſubſtance of all the three portions is moſtly ſpungy, except in the middle of the Os Ilium, where the two tables uniting, render the bone tranſparent; and the ſame is to be ſaid of the acetabulum.

Connection.

602. The Oſſa Innominata are joined to the Os Sacrum, and to each other by a cartilaginous ſymphyſis. They are articulated with the Os Femoris by enarthroſis, as we ſhall ſee in deſcribing that bone.

Uſes.

603. The Oſſa Innominata, together with the Os Sacrum, form the pelvis, which is part of the cavity of the abdomen, and ſupports ſeveral viſcera, eſpecially thoſe which are the common-ſewers of the urine and groſs excrements, and thoſe by which the two ſexes are diſtinguiſhed. The pelvis is larger in women than in men; the Oſſa Ilium and Iſchium are wider. The arch formed by the branches of the Oſſa Pubis is likewiſe greateſt in females.

604. Moreover, theſe bones, together with the Os Sacrum, ſupport the whole trunk and all the parts belonging to it,

and alſo the lower extremities. In a word, they are the baſis of the whole body of man, and the general centre of all its motions, when ſtanding, ſitting, or lying.

A R T. IV.

The bones of the upper extremities.

605. THE upper extremities of the human body are two in number; fixed to the upper and lateral parts of the trunk, from whence they may be extended below the inferior part thereof, that is, below the pelvis. Each of them is divided into four parts, the ſhoulder, the arm, the fore-arm, and the hand.

§ 1. *The bones of the ſhoulder; and firſt, the Scapula.*

606. The ſhoulder is made up of two bones, one large and poſterior, called *the ſcapula;* the other ſmall and anterior, named *the clavicle.*

Situation in general and figure of the Scapula.

607. The ſcapula is a large bone, in ſome meaſure of a triangular figure, ſituated laterally at the upper and poſterior part of the thorax, from about the firſt rib down to the ſeventh.

Diviſion.

608. It may be divided into two ſides, one external or poſterior and convex, the other internal or anterior and concave; three edges, one named *the baſis,* and two named *coſtæ,* one ſuperior, the other inferior; three angles, one anterior, called *the head* or *neck,* one ſuperior, and one inferior. I ſhall begin with the edges, and end with the ſides.

609. The baſis is the longeſt edge of the ſcapula. It is commonly ſituated on one ſide of the ſpine, a little obliquely, the upper part of it being nearer the vertebræ than the lower. It is, as it were, divided into two parts by a very obtuſe angle, which diſtinguiſhes the ſuperior quarter from the three other quarters. It is conſiderably thick, and is accordingly divided into two labia, one exterior, the other interior. It continues to be an epiphyſes in many adult ſub-

jects, towards both its extremities, eſpecially towards the lower.

610. The ſuperior coſta is the ſhorteſt and thinneſt of the three edges, It is ſituated almoſt tranſverſely between the ſuperior point of the baſis and neck of the ſcapula, being a little more raiſed toward the baſis than at the other end, where it often terminates by a ſmall notch. It is divided into an external and internal labium.

611. The inferior coſta is of a middle length between the other two edges. Its ſituation is very oblique between the inferior point of the baſis and neck of the ſcapula. It is thicker than the reſt, and often appears to be double, having two very diſtinct labia, the uttermoſt of which is thin, the other round. Theſe two labia are ſeparated by a kind of channel, or groove; and upon the external labium is a narrow impreſſion, which runs from the neck through two thirds of the length of the coſta.

612. The neck of the ſcapula is the biggeſt of the three angles. It ought more juſtly to be called a *head* with a very ſhort neck; and a ſuperficial or glenoide cavity in the top of it, which is lined with a cartilage and of an oval figure, but pointed at the upper part, and rounded at the lower; and deeper in the natural ſtate than in the ſkeleton, as will be ſeen in the hiſtory of freſh bones. In the natural ſituation of the ſcapula this cavity is turned obliquely forward, and not directly outward. Between the edge of this cavity and the contracted part which is the true neck, ſome inequalities are obſervable, which are the remains of the ſymphyſis of oſſification.

613. At the upper part of the neck there is a production or epiphyſis reſembling a crooked finger or crow's bill, called *the coracoide apophyſis* or *epiphyſis*, which at its origin has a tuberoſity, for the inſertion of the ligaments of the clavicle It terminates by three muſcular impreſſions, which all together form an obtuſe point.

614. The angles next the baſis have nothing very remarkable, only that the ſuperior is more acute than the inferior in ſome ſubjects.

615. The outſide of this bone is unequally convex, and, a little below the ſuperior coſta, ſhows a long, high, thin eminence, called the *ſpine of the ſcapula*, which riſes gradually

higher from the curvature or obtuſe angle at the baſis all the way to the neck, and afterwards turns upwards and forward over the coracoide apophyſis, forming another broad apophyſis called the *acromium*. The name of *criſta* is given to the edge of this ſpine.

616. This criſta is extended in breadth in three particular places. The firſt is near the baſis of the ſcapula, where there is a ſmooth triangular ſurface. The ſecond is a kind of oblong, flat, and rough tuberoſity. The third is at the acromium, of which already. On the anterior edge of this apophyſis, near its point, is a ſmall cartilaginous apophyſis for the articulation of the ſcapula with the clavicle.

617. The body of the ſpine divides the outſide of the ſcapula in two portions, the uppermoſt and leaſt of which is termed *foſſa ſupra-ſpinalis*, the loweſt and largeſt, *foſſa ſub-ſpinalis*, in which we obſerve a long depreſſion, lying a little above the coſta inferior, and running from the inferior angle to the neck. Near this inferior angle we ſee likewiſe a kind of ſmall diſtinct ſurface unequally triangular and oblong, which runs up upon the inferior coſta towards the channel or groove in its external labium.

618. The inſide of the ſcapula is irregularly concave, chiefly toward the upper part, and, in a manner, divided into ſeveral ſuperficial and longitudinal foſſulæ, by little ridges which run like radii from the neck toward the baſis. The direction of theſe lines is tranſverſe with reſpect to that of the ribs.

619. Beſides theſe parts, we obſerve likewiſe three notches; one very large, between the neck and the ſpine; one ſmall, between the ſuperior coſta and the coracoide apophyſis; and one of a middle ſize, between that apophyſis and the glenoide cavity. There is ſometimes a particular hole which either perforates the baſis of the ſpine at its middle, or is there loſt in the ſubſtance of the bone.

620. We muſt not forget here, two ſmall rough marks or impreſſions immediately above and below the glenoide cavity; the loweſt of which extends itſelf a little over the neighbouring coſta. They might be termed muſcular impreſſions of the neck of the ſcapula.

Subſtance.

621. In the neck, ſpine, baſis, inferior coſta, and coracoide proceſs, there is a diploë, the reſt

of the bone is tranſparent, thin, and almoſt without any middle cellulous ſubſtance.

Connection and uſes.

622. The ſcapula is articulated with the clavicle, by the acromium, and with the Os Humeri, by the glenoide cavity. It is likewiſe joined to the trunk by a fleſhy ſymphyſis or ſyſſarcoſis. It ſerves to facilitate the motions of the arm, to give inſertion to a great many muſcles, and as a ſhield, to defend the back-parts of the thorax.

§ 2. *Clavicula.*

Situation in general.

623. The two clavicles are ſituated tranſverſely and a little obliquely, oppoſite to each other, at the ſuperior and anterior part of the thorax, between the ſcapula and the ſternum.

Figure.

624. Each clavicle reſembles in ſome meaſure an Italic *ſ*, being a long bone, irregularly cylindrical, bent forwards near the ſternum, and backward near the ſcapula, as if it were made up of two arches joined endwiſe in oppoſite directions, that which lies on the fore-part of the breaſt being the largeſt. The clavicles are ſtreighter in women than in men.

Diviſion.

625. The clavicle is divided into a body or middle part, and two extremities, one anterior, inferior, and internal, which I term the pectoral or ſternal extremity; the other poſterior, ſuperior, and external, which I name the humeral or ſcapular extremity.

626. The pectoral extremity is the thickeſt, and of a triangular figure, eſpecially near the end, where it is a little enlarged, and ſhows a cartilaginous ſurface with three angles, of which the loweſt is the moſt prominent, and turned a little toward the cavity of the thorax. Near theſe angles there are ſeveral muſcular and ligamentary impreſſions, one of which near the inferior angle is ſometimes raiſed like a tubercle.

627. The humeral extremity is flat and broad, and two ſides may be conſidered in it, one ſuperior, the other inferior; likewiſe two edges, one anterior, the other poſterior; and a ſmall articular ſurface.

628. The upper ſide has ſeveral inequalities, and in the lower there is a kind of oblong rough oblique tuberoſity. The

poſterior edge is convex, thick, and uneven, being that of the ſmall arch of the clavicle. The anterior edge is concave, narrow, and ſmooth every where, except near the great arch where it has a rough impreſſion. The articular ſurface terminates this extremity, being cartilaginous, turned obliquely forward, and of an oval figure, like that of the acromium, with which it is articulated.

629. The body or middle portion, which, together with the pectoral extremity, forms the great curvature of the clavicle, is not ſo thick as the extremities. It is a little flatted, both on the upper and lower ſides, and therefore two edges may likewiſe be diſtinguiſhed in it. The upper ſide is pretty even, the lower ſomething rougher, and a little depreſſed by a ſuperficial channel. The edges are rounded, the anterior being convex, the poſterior concave.

630. The inner ſubſtance of the extremities is cellulous. The reſt is more ſolid, conſiſting of very thick ſides, with a narrow cavity more or leſs filled with reticular bony filaments. *Subſtance.*

631. The particular ſituation of this bone is eaſily underſtood from what has been ſaid. The moſt uneven ſide of the body, and rough ſide of the humeral extremity, are always to be turned downward. *Situation in particular.*

632. The clavicle is articulated with the acromium and ſternum by arthrodia. The articulation with the ſcapula, by means of the acromium, is as real and diſtinct as the articulation with the ſternum; which laſt appears ſomething extraordinary in the ſkeleton, where the ſmall notch in the ſternum is nowiſe proportioned to the broad extremity of the clavicle. In the deſcription of the freſh bones, I ſhall ſhow how this is to be accounted for; and likewiſe demonſtrate the ligamentary connections. *Connection.*

633. The clavicles ſerve for butreſſes to the ſcapulæ, and bound their motions forward and upward; by their ligamentary connections they likewiſe hinder the ſcapulæ from running too far back; which might happen in thoſe who drag burdens behind them, *&c.* They alſo give inſertion to many muſcles. *Uſes.*

§ 3. *Os*

§ 3. *Os Humeri.*

634. The Os Humeri or bone of the arm is both longer and thicker than any other bone of the upper extremity. It is ſituated under the acromium, along the lateral part of the thorax, from which however it may be removed to a conſiderable diſtance, in all directions. Its figure is irregularly cylindrical, and it is thick at one end, and broad at the other.

Situation in general, ſize, and figure.

Diviſion.

635. It is divided into the body, and two extremities, or into an upper, middle, and lower part.

636. The upper part is generally called the *head of the Os Humeri,* and the part immediately below that, is called the *neck.*

637. In the head we conſider a half-globe obliquely inclined, cruſted over with a ſmooth cartilage: two tuberoſities, one large, terminating upwards in a point, over againſt the half-globe; the other ſmall, placed laterally between the large one and the half-globe; a channel or groove between the two tuberoſities; four muſcular impreſſions, three of which are on the large tuberoſity, one in the apex, one on the ſide oppoſite to the groove, and the third lower down on the ſame ſide over-aginſt the ſmall tuberoſity upon which the fourth is found. Of theſe four impreſſions, that on the ſmall tuberoſity, and the ſecond of the other three, are the largeſt. All theſe parts of the head of the Os Humeri are one epiphyſis in children, of which very plain marks remain ſometimes in an advanced age.

638. The channel or groove between the two tuberoſities is continued downwards in an oblique direction through one quarter of the length of the bone, and there becoming rough, it forms a muſcular impreſſion not always equally ſenſible. The edges of this channel are two ridges or prominent lines continued down, as it were, from the two tuberoſities. That from the great tuberoſity is the moſt conſiderable, and is continued down to the middle of the bone, where it is loſt in a long, broad, raiſed muſcular impreſſion more or leſs rough. The other which comes from the ſmall tuberoſity, is leſs prominent and ſhorter. At the ſide of this ridge, toward the lower part, are two other narrow longitudinal and

ſuperficial muſcular marks one above the other, the lower extremity of the firſt reaching down on the foreſide of the upper extremity of the ſecond.

639. The middle part or body of the Os Humeri comes nearer to a cylindrical figure than the extremities. It is a little raiſed at the rough eminence or impreſſion already mentioned. On each ſide of this eminence is another muſcular impreſſion, which uniting immediately below it, it appears to be incloſed between them as between the two prongs of a fork. On that ſide which anſwers to the middle of the half-globe, we ſee likewiſe a longitudinal muſcular mark, and about the middle of that ſide which is even with the great tuberoſity, there is an oblique hollow turning of a conſiderable length and breadth, which running down by the ſide of the forked impreſſion, makes this part of the bone appear contorted.

640. The lower extremity of the Os Humeri is triangular from its very beginning, and from thence grows very broad and flat, being bent a little near the end, towards that ſide which anſwers to the ſmall tuberoſity in the upper extremity. It is divided into three ſides, two anterior, and one poſterior, which is the broadeſt; and into three angles, one anterior, and two lateral.

641. At the end of this broad extremity are two tuberoſities, one ſhort and prominent, anſwering directly to the middle of the half-globe, the other oblong, rough, and reſembling a criſta, which anſwers to the apex of the great tuberoſity of the head. The ſhort tuberoſity is called the internal condyle, the other the external condyle.

642. Between theſe two condyles, on the very loweſt part of the concave ſide of this extremity, are two articular eminences, one double like a pulley, next the ſhort condyle; the other rounded like a ſmall head, next the long condyle. The pulley has a great and ſmall edge with a depreſſion between them. The ſmall edge is loſt in the round eminence or head, the great one is gradually widened, and ends in a ſharp circumference. This pully is ſituated obliquely; for on the concave ſide it approaches toward the ſhort condyle, and on the other, it is turned from it.

643. Three foſſulæ are likewiſe obſervable in this lower part of the bone, two anterior, one immediately above the

Pulley, the other above the ſmall head; and one poſterior, which is very large, and ſituated likewiſe immediately above the pulley. In children, the pulley, the ſmall head, and the ſhort condyle are epiphyſes.

Subſtance. 644. The outer ſubſtance of this bone is compact, eſpecially in the middle part, within which there is a large tubular cavity, containing a reticular texture of bony filaments. The outſides of the extremities are leſs ſolid, and their inner ſubſtance is cellulous.

Situation in particular. 645. The particular ſituation of this bone deſerves well to be conſidered, becauſe we are often miſled in forming an idea of it, by viewing the bone itſelf ſeparated from the trunk of the body, by the figures which have been given of it, and by the undue application of the terms *external*, *internal*, *anterior*, and *poſterior*, to the different parts thereof; which miſtakes may be of very bad conſequence in many chirurgical caſes.

646. When we examine the Os Humeri, as lying along either ſide of the trunk, in its natural ſituation; the head will be found ſo diſpoſed as that the half-globe is turned inward and backward, anſwering to the ſituation of the glenoide cavity of the ſcapula; the great tuberoſity outward and forward; the channel between the two tuberoſities, almoſt directly forward; the long condyle, ſaid commonly to be external, turned as much forward as outward; and the ſhort condyle called the *internal*, turned as much backward as inward.

Connection. 647. This bone is articulated above with the glenoide cavity of the ſcapula, by enarthrodia, which is much plainer in the freſh bones than in the ſkeleton; and below, with the two bones of the fore-arm, in the manner hereafter to be deſcribed.

Uſes. 648. The uſes of this bone are generally well enough known. The explication of all its different motions preſuppoſes the knowledge of the freſh bones, and of their ligaments and muſcles; and therefore muſt be referred to another place.

§ 4. *The*

§ 4. *The bones of the fore-arm; and firſt, the Ulna.*

649. The fore-arm is made up of two long bones, whereof one is named *cubitus* or *ulna*, the other *radius*.

Figure and diviſion of the ulna.

650. The ulna is irregularly triangular, diminiſhing in thickneſs from one end to the other. It may be divided into the body or middle part, and two extremities, one great, the other ſmall.

651. In the great extremity we obſerve two eminences, one large, called *olecranum* or *ancon*, the other ſmall, called *corone* or the *coronoide apophyſis*; and two ſemilunar or ſigmoide cavities, one great, the other ſmall.

652. The olecranum is a large apophyſis ending in a rough tuberoſity and an obtuſe point. The tuberoſity makes the corner of the elbow; the point is lodged in the poſterior cavity of the lower extremity of the Os Humeri, when the fore-arm is extended. Next under the tuberoſity is a flattiſh oblong, triangular ſurface, on the outſide of which is another of the ſame kind, but longer and a little hollow, together with a muſcular foſſula.

653. The coronoide apophyſis is prominent and a little pointed, reſembling a broad ſhort beak. It is received into the anterior cavity above the pulley, at the lower extremity of the Os Humeri, when the fore-arm is bent.

654. The great ſigmoide cavity lies directly between theſe two eminences, reaching from the point of one to the point of the other. It is articular, covered with a ſmooth cartilage, and divided through its whole length by a middle angular line; being thus ſuited exactly to the pully of the Os Humeri upon which it moves obliquely; theſe two together making a moſt perfect ginglymus, as well in reſpect of their ſtructure as of their uſe. The half-cavities on each ſide the angular line are alſo divided tranſverſely by another line a little hollow, which terminates at the middle of each edge of the cavity, by a very ſmall notch.

655. The ſmall ſigmoide cavity, which may likewiſe be termed tranſverſe or lateral, is a ſort of tranſverſe notch in the inferior portion of one edge of the great ſigmoide cavity, at the ſide of the coronoide point, directly oppoſite to the muſcular foſſula already mentioned. It is covered with

a cartilage as well as the great one, of which it appears to be a true continuation, and it belongs to the articulation of the radius. Near this cavity, directly under the coronoide apophyſis, there is a very rough muſcular impreſſion, ſometimes raiſed like a tuberoſity.

656. This upper extremity is oblique, and its obliquity anſwers to that of the pulley in the Os Humeri.

657. The ſmall extremity is cylindrical, of a leſs diameter than any other part of the bone. It may be reckoned a kind of neck ending in an inverted head, flat at top, and of a cylindrical circumference, both which are covered with the ſame ſmooth cartilage, and the circumference is broader on the ſide of the coronoide apophyſis, and ſmall ſigmoide cavity, than any where elſe. From the head runs down a ſhort ſtyloide apophyſis, on the ſide of the tuberoſity of the olecranum, diſtinguiſhed from the reſt of the circumference by a ſmall notch.

658. The middle portion or body of the ulna is divided into three ſides, and three angles. One of the ſides is narrow and rounded, one broad and hollow, and the third flat, and marked with an oblique line on its upper part. The narrow ſide anſwers to the tuberoſity of the olecranum, and is covered only by the common integuments. The other two ſides are diſtinguiſhed from the former by two blunt angles; and they unite at a ſharp angle which lies oppoſite to the rounded ſide, and anſwers to the point of the coronoide apophyſis. The hollow ſide is even with the ſmall ſigmoide cavity, and the flat ſide oppoſite to it. Theſe two ſides give inſertion to many muſcles, and the ſharp angle, to what is called the *intereſſeous ligament*. At the top of this angle there is a narrow oblong muſcular impreſſion. The angle common to the rounded and flat ſides, ends below in an oblong uneven muſcular eminence.

Subſtance. 659. The ſubſtance of the ulna is much the ſame with that of the Os Humeri, already deſcribed. The tuberoſity of the olecranum, and the ſmall inferior head, with its ſtyloide apophyſis, remain for a long time epiphyſes in ſome ſubjects.

Connection. 660. It is connected with the pulley of the Os Humeri by an angular ginglymus; with the two extremities of the radius, by a compound lateral ginglymus, and with the hand by ligament, and not by articulation.

Situation in particular.

661. the ſituation of this bone may be conſidered two ways, either when the fore-arm is extended, and lies along the ſide of the trunk, or when it is bent, and lies on the lower part of the breaſt. The firſt ſituation appears to be moſt commodious for determining what parts of the bone are to be called *anterior*, *poſterior*, *ſuperior*, *inferior*, *external*, and *internal*. But the ſecond ſeems moſt natural, as being the moſt common in living bodies, whether ſitting or ſtanding, and has accordingly been followed by ſome of the ancients. I ſhall have occaſion to ſay ſomething more upon this head, in deſcribing the radius and bones of the hand.

§ 5. *The Radius.*

Size, figure, and ſituation in general.

662. The radius is nearly of the ſame length with the ulna, bigger at one end than at the other, irregularly triangular, a little bent, and ſituated along the ſide of the ulna. Its name is taken from the reſemblance it bears to the ſpoke of a wheel.

663. We are to conſider in this bone two extremities, and a middle portion. One extremity is ſmall, and like a kind of head ſet upon a neck; the other is large, reſembling a pedeſtal or baſis; and therefore it might be divided into a head, body, and baſis.

Diviſion.

664. The head or ſmall extremity of the radius is very ſhort or low, the top of it is concave, and the circumference cylindrical; and both the glenoide cavity and circumference are covered with the ſame ſmooth ſhining cartilaginous cruſt; and about one quarter of the circumference is broader than the reſt. The neck is ſmall, and its ſituation a little oblique. It ends by a lateral tuberoſity which lies directly under the broad part of the head, being rough in the middle and on one ſide, and ſmooth and ſuperficially cartilaginous on the other.

665. The baſis or great extremity of the radius is much broader than it is thick, and has two broad ſides and one narrow. One of the broad ſides is a little hollow and pretty even; the other is unequally convex, and divided by longitudinal eminences, or bony lines, into three or four longitu-

dinal channels, much more diſtinct in freſh bones than in the ſkeleton. The narrow ſide is hollowed lengthwiſe, and between it and the other two, two angles are formed, by which the three ſides are diſtinguiſhed, and oppoſite to it, the other two meet in a third angle. This narrow ſide ends in a ſemilunar cavity bordered with a ſmooth cartilage, and lying almoſt in the ſame direction with the tuberoſity. The broad ſides end at their common angle, by an obtuſe point or production, which has been called *the ſtyloide apophyſis* of the radius, and is really a continuation of one of the bony lines already mentioned.

666. The whole baſis ends in an oblong, triangular, glenoide cavity, the cartilage of which is continued over the hollow edge of the narrow ſide. This is an articular cavity reſembling an arch, and ending on one ſide at the ſtyloide apophyſis, and hollowed on the other by the cavity of the narrow ſide. It appears divided into two portions by a ſmall tranſverſe line, and in the natural ſtate the hollowed ſide is lengthened out by a cartilaginous production, the deſcription of which belongs to the hiſtory of freſh bones.

667. The middle or body of the radius is a little incurvated, the concavity lying between the tuberoſity in the head and ſemilunar cavity in the baſis. It has three ſides; one rounded, which is the convex ſide of the curvature, and two concave: three angles, two of which are obtuſe, diſtinguiſhing the two concave ſides from the convex; and the third ſharp, lying between the two concave ſides, oppoſite to the convex ſide. In each of theſe ſides there are ſeveral muſcular marks.

Subſtance. 668. The ſubſtance of this bone is like that of the ulna. The head and baſis are epiphyſes in children, and in ſome ſubjects remain ſuch for a long time afterward.

669. The radius is connected with the ulna, Os Humeri, *Connection.* and carpus. It is articulated with the ulna, at its two extremities, by a double lateral ginglymus; the cartilaginous circumference of the head turning in the ſmall ſigmoide cavity, and the ſemilunar cavity in the baſis turning upon the ſmall head at the lower extremity of the other bone; and thus the ſmall extremity of one bone is joined to the great extremity of the other.

670. It is articulated with the Os Humeri, by the application of the cavity in the top of its head, to the ſmall head, at the lower extremity of the other bone. By this conformation it would be capable of moving in all directions; but as it is tied to the ulna at both extremities, its motions on the ſmall condyloide head at the lower extremity of the Os Humeri, are confined to two kinds; that of rotation when it turns on the ſides of the extremities of the ulna, and that of flexion and extenſion, in common with the ulna; and both theſe motions may be performed at the ſame time.

671. The articulation of the radius with the bones of the carpus, ſhall be explained in deſcribing theſe bones.

§ 6. *The bones of the hand; and firſt, the bones of the carpus.*

Situation in general, and diviſion of the hand.

672. The hand is the laſt part of the upper extremity, and is divided into the carpus, metacarpus, and fingers, as has been already ſaid in the enumeration of the bones of the ſkeleton. It may be further divided into the concave and convex ſide. The concave ſide is likewiſe called *the inſide,* becauſe it is commonly, and as it were, naturally turned toward the body, and ſo hid. The convex ſide is, for the ſame reaſon, named *the outſide*, as being for the moſt part turned outward and expoſed to view, The firſt is alſo named the *hollow* or *palm* of the hand; the other, the *back* of the hand.

Situation in general, and diviſion of the carpus.

673. The carpus or wriſt conſiſts of eight ſmall, unequal, and irregular bones; and taken all together, they repreſent a ſort of grotto of an irregular quadrangular figure, and connected principally with the baſis of the radius. Conſidered in this manner, the whole collection of them has two ſides, and four edges. One of the ſides is convex and external, the other concave and internal. The convexity of the outſide is pretty uniform, but the inner or concave ſide has four eminences, one at each corner. One of the four edges touches the fore-arm, and is, as it were, the head of the carpus; another edge may be termed *the baſis*, and touches the metacarpus; the third is toward the point of the radius; and the fourth toward the point of the ulna. The firſt of theſe laſt I ſhall call *the ſmall edge*, the other *the great edge*.

674. The bones of the carpus are divided into two rows; the firſt of which lies next the fore-arm; the ſecond next the metacarpus. Each row conſiſts of four bones, but the fourth of the firſt row lies, in a manner, out of its rank. Each bone has ſeveral cartilaginous ſurfaces, for their mutual articulations; and in ſome of them for their articulations with the radius, and bones of the metacarpus, and thumb.

675. It is to no purpoſe to diſtinguiſh the three ordinary dimenſions in any of theſe bones except one; but in moſt of them we may conſider ſix ſides; one external, turned toward the convex ſurface of the carpus: one internal, toward the concave ſurface; one towards the fore-arm, which I call *the brachial ſide*; one toward the fingers, which I call *the digital ſide*; one towards the point of the radius, or the radial ſide; and one towards the point of the ulna, or the cubital ſide.

676. Of theſe ſides ſome are bony, other cartilaginous or articular. Theſe laſt I ſhall call *ſides*, the other *ſurfaces*, as being portions of the common ſurface of the carpus in its natural ſituation.

677. To diſtinguiſh theſe eight bones from each other, they are called *firſt*, *ſecond*, *third*, and *fourth bones* of the firſt or ſecond row, beginning to count from the radius or thumb.

678. Lyſerus has been at pains to give a particular name to each of them. He calls the firſt bone of the firſt row *Os Scaphoides*, or *Naviculare*; the ſecond, *Os Lunare*; the third, *Os Cuneiforme*; the fourth, *Os Piſiforme*: the firſt bone of the ſecond row, *Os Trapezium*; the ſecond, *Os Trapezoides*; the third, *Os Magnum*; and the fourth, *Os Unciforme*.

Os Scaphoides. 679. The firſt bone of the firſt row is termed *Scaphoides* in Greek, and *Naviculare* in Latin, from its reſemblance to a ſmall boat. Next the radius it has a convex ſide, by which it is articulated with the baſis of that bone and a tubercle, which is one of the four eminences on the concave ſide of the carpus. Toward the thumb it has two half-ſides, one large one, for the Os Trapezium, and a ſmall one, for the Os Trapezoides. It has likewiſe a hollow ſide for the Os Magnum, and a ſmall ſemilunar ſide, for the Os Lunare. The inner and outer ſurfaces are rough.

680. The

Os Lunare.

680. The ſecond bone of the firſt row is called *Lunare*, becauſe one of its ſides is in form of a creſcent. The articular ſides in this bone are four in number; one convex for the baſis of the radius; one ſemilunar, for the Os Scaphoides; one almoſt triangular, for the Os Cuneiforme; and one hollow, which, with the hollow ſide of the Os Scaphoides, forms a cotyloide cavity for the head of the Os Magnum. The convex ſide, together with that of the Os Scaphoides, forms an oblong convexity anſwering to the oblong concavity in the baſis of the radius. The outer and inner ſurfaces are ſmall and rough. This bone would be better named *Os Semilunare.*

Os Cuneiforme.

681. The third bone of the firſt row, called *Cuneiforme*, from its figure, appears rather like a wedge ſticking between the two rows. It has a rough ſurface with a ſmall tubercle upon it, which forms the greateſt part of the cubital edge of the carpus; and four articular ſides, whereof one is convex, which completes the articular convexity of the carpus; one orbicular and internal, or on the concave ſide of the carpus, on which the Os Piſiforme is ſet; and two which make an angle between them, one for the Os Semilunare, and the other for the Os Unciforme.

Os Orbiculare.

682. The fourth bone of the firſt row called *Orbiculare*, *Piſiforme*, and *Lenticulare*, from its figure and ſize, is irregularly round. It has but one cartilaginous ſide irregularly orbicular, the border or circumference of which repreſents a ſort of narrow collar. The reſt of the bone is rough, convex, and irregularly round, making one of the four eminences on the concave ſide of the carpus. This bone and the Os Cuneiforme may be ſuppoſed to make a third row diſtinct from the other two.

683. The four bones of the ſecond row lie all in a line, the firſt being articulated with the thumb, the reſt with the metacarpus.

Os Trapezium.

684. The firſt bone of the ſecond row is named *Trapezium*, as being ſuppoſed to be of an unequal ſquare figure. Its outer ſurface is rough, and makes a portion of the convex ſide of the carpus. On its inner ſurface is an oblong eminence, which makes one of the four eminences on the concave ſide of the carpus; and on the

ſame ſide it has a groove or channel. There is likewiſe a ſmall tubercle on the outer ſurface.

685. It has ſeveral articular cartilaginous ſides, *viz.* one brachial, one digital, and two cubital ſides.

686. The brachial ſide, which is hollow, is articulated with the Os Scaphoides; the digital, with the firſt phalanx of the thumb; one of the cubital ſides, with the Os Trapezoides, and the other with the firſt bone of the metacarpus.

687. The ſide which is articulated with the firſt phalanx of the thumb, appears to be made up of two ſuperficial ſigmoide or ſemilunar half-ſides, diſtinguiſhed by an eminence of the ſame figure, being each more hollow toward the ſides than at the middle, which makes a portion of a ſort of ſuperficial pulley with the edges much worn.

688. One of the cubital ſides which is articulated with the Os Trapezoides is large; the other which joins the firſt metacarpal bone is ſmall.

Os Trapezoides.

689. The ſecond bone of the ſecond row deſerves the name of *Pyramydale*, rather than *Trapezoides*; being a kind of pyramid with the point broke off. Its baſis makes a portion of the outer or convex ſide of the carpus, and its point a part of the concave ſide.

690. It has ſeveral articular ſides, *viz.* one brachial, which is the leaſt of all, and articulated with the Os Scaphoides; one digital, of a conſiderable length, notched on each ſide and divided into two halves, by a ſort of middle line or angle, which gives it the appearance of a pulley, articulated with the baſis of the firſt metacarpal bone; one radial, irregularly triangular, and articulated with the Os Trapezium; and one cubital, a little hollow and articulated with the Os Magnum.

Os Magnum.

691. The third bone of the ſecond row, called *Os Magnum*, is the largeſt of all the bones of the carpus. It is of a conſiderable length, and has a kind of articular round head, which is received into the cotyloide cavity formed by the two firſt bones of the firſt row; and this articulation is capable of a ſmall degree of flexion and extenſion.

692. The digital ſide is a cartilaginous baſis, unequally and obliquely triangular, the apex being turned inward. It is articulated with the ſecond metacarpal bone, and is alſo a

little notched on the radial edge for its articulation with the ſmall edge of the firſt metacarpal bone.

693. The radial ſide is very ſmall and near the baſis, being articulated with the Os Pyramidale; the reſt of this ſurface is without cartilage. The cubital ſide is double, anſwering to a like ſide in the Os Unciforme with which it is articulated.

694. The outer ſurface which forms a portion of the convex ſide of the carpus, is broad, rough, and uneven, for the inſertion of ligaments. The inner ſurface is likewiſe rough, but narrower, and round both ſurfaces are ſeveral depreſſions which in the natural ſtate are filled with ſmall glands, ligaments, &c.

Os Unciforme.

695. In the fourth bone of the ſecond row, we are to conſider the body and hooked or unciform apophyſis, from whence it has the name of *Unciforme.* This apophyſis, one of the four eminences on the concave ſide of the carpus, is flat, and the hollow ſide of its curvature turned towards the Os Magnum.

696. The outer ſurface of its body is rough, and, in ſome meaſure triangular. It completes the convex ſide of the carpus, and toward the ulna, terminates in a ſmall tuberoſity, which is all the cubital ſide of this bone.

697. It has three articular or cartilaginous ſides, one radial, one brachial, and one digital.

698. The radial ſide is double, anſwering to the cubital ſide of the Os Magnum. The brachial ſide is very oblique, ſome part of it being gently concave, the reſt gently convex, anſwering to the digital ſide of the Os Cuneiforme. The digital ſide is double, or diſtinguiſhed into two halves, by a ſigmoide angular line, for its articulation with the two laſt bones of the metacarpus.

Connection and ſubſtance.

699. The bones of the carpus are articulated with each other by arthrodia; but the firſt row forms a ſort of ginglymus with the ſecond, becauſe the head of the Os Magnum may turn in the cotyloide cavity of the firſt row, while the two firſt bones of the ſecond row ſlide upon the digital ſide of the Os Scaphoides, and the Os Unciforme in the ſame manner on the Os Cuneiforme.

700. When all theſe bones are in their natural ſituation, a

tranſverſe depreſſion is formed on the convex ſide of the carpus, by which the two rows are diſtinguiſhed. This depreſſion appears moſt between the Os Scaphoides and the three laſt bones of the ſecond row, and looks like a kind of fold by which the ſecond row is thrown back upon the firſt. The four eminences on the concave ſide of the carpus, are for the inſertion of a ſtrong tranſverſe ligament. The inner ſubſtance of all theſe bones is ſpungy, and their ſurfaces are not very compact.

§ 7. *The bones of the Metacarpus.*

701. *Situation.* The metacarpus is the ſecond part of the hand, ſituated between the carpus and fingers. The ancients, who called the carpus *brachiale*, from whence the word *bracelet* ſeems to be derived, termed the metacarpus, *poſt-brachiale.*

702. *General diviſion.* The metacarpus conſiſts of four bones, one ſide of which forms a broad cavity, called *the palm of the hand*; the other, a gentle convexity, called *the back of the hand.* The ancient anatomiſts reckoned five bones in the metacarpus, including that bone which is now looked upon as the firſt phalanx of the thumb.

703. *Figure and ſize.* The bones of the metacarpus are long, thicker at the extremities than at the middle, and of unequal length and bigneſs. The firſt is the largeſt, the reſt are leſſened by degrees in all their dimenſions. The two firſt are ſometimes, though very rarely, equal.

704. *Particular diviſion.* Each bone is divided into the extremities and middle part; or into a baſis, body, and head. The baſes are angular, and turned toward the carpus; the heads rounded like condyles, and turned toward the fingers. Both are covered with cartilages, and the heads remain for a long time very diſtinct epiphyſes.

705. The baſes are narrow and almoſt angular toward the palm of the hand; toward the back of the hand their breadth is conſiderable, but on the other two ſides they are very broad; and there they have ſmall articular ſides, which I call *lateral ſides.* The heads are flatted on the two ſides, which anſwer to the lateral ſides of the baſis, and their greateſt convexity is turned toward the palm of the hand, terminating in two obtuſe points. Several notches and foſſulæ break

in upon the lateral ſides, and the flat ſides of the heads are a little depreſſed, a ſmall tubercle ariſing in the middle of each depreſſion.

706. The body of each bone is contracted, of a triangular figure, and diſtinguiſhed into three ſides, whereof one is external and a little convex, contributing to make the back of the hand; the other two internal and a little concave, one being turned obliquely toward the radius, the other toward the ulna. Theſe three ſides are ſeparated by the ſame number of angles, and that angle which parts the two internal ſides is ſharp. It is by theſe two ſides and the angle between them, that the hollow of the palm of the hand is formed.

Firſt bone.

707. The firſt bone of the metacarpus is longer, thicker, and bigger than any of the reſt, and ſupports the fore finger. Its baſis is a little hollow, anſwering to the digital ſide of the Os Pyramidale of the carpus. On the outer edge there is a ſmall angular notch, and on the cubital edge of the baſis a ſmall lateral ſide which is articulated with the baſis of the ſecond bone. The inner edge is terminated laterally by an oblique angle, which is articulated with the neighbouring angle in the baſis of the Os Magnum. Round the baſis are inequalities and depreſſions for the ligaments and articular glands. The outſide of the body of the bone is broader toward the head than toward the baſis.

Second bone.

708. The ſecond bone of the metacarpus ſupports the middle finger, and has this peculiar to it, that its baſis is very oblique, terminating at the outer edge, by an angular point turned toward the firſt bone. By the triangular ſide of its baſis, it is articulated with the baſis of the Os Magnum, and by its lateral ſides with thoſe of the firſt and third bone of the metacarpus.

Third bone.

709. The third bone of the metacarpus ſupports the ring-finger, being leſs than the firſt and ſecond. Its baſis is irregularly triangular, and proportionably leſs than the two former; and by the principal ſide thereof, it is articulated with the firſt half of the ſide of the Os Unciforme. The ſmall lateral ſides of the baſis join thoſe of the ſecond and fourth bone of the metacarpus.

Fourth bone.

710. The fourth bone of the metacarpus ſupports the little finger. The principal ſide of its baſis, inſtead of being triangular, as in the other bones, is

all of an equal breadth, a little oblique, and ſome part of it gently convex, the reſt gently concave, and articulated with the ſecond half of the ſide of the Os Unciforme. By its lateral ſide it joins the correſponding ſide of the baſis of the third bone, but in a much looſer manner than in the other articulations of the like kind. In the oppoſite ſide there is a ſmall tuberoſity.

§ 8. *The bones of the fingers.*

711. The fingers make the third part of the hand, and terminate the whole upper extremity. They are five in number in each hand, called *the thumb*, *the fore-finger*, *the middle finger*, *the ring-finger*, and *the little finger*.

Situation, number, figure, and ſize.

712. They may be ſaid in general to repreſent the ſame number of compound, long, ſmall, bony pyramids, convex on one ſide, gently concave on the other, and joined by their baſes to the carpus and metacarpus, from whence they diminiſh gradually, and end in a ſort of ſmall heads.

713. The thumb is the biggeſt of all the fingers; next to that is the third, called *the long finger*. The ſecond and fourth are ſhorter than the third; the fourth being a very little longer than the ſecond. The fifth is the ſmalleſt of all.

714. Each finger conſiſts of three pieces, called *phalanges*; the firſt of which is longer and thicker than the ſecond, and the ſecond, than the third. Each phalanx is divided in the ſame manner as an entire finger, into a baſis, middle portion, and head; into two ſides, one convex, the other concave; and into two edges. The baſis of the phalanges remain epiphyſes for a long time, as well as the heads of the metacarpal bones.

Diviſion.

715. The firſt phalanx of the thumb is not like thoſe of the other fingers. Ancient authors reckoned it among the bones of the metacarpus, which it reſembles very much, and then they counted five metacarpal bones, allowing only two phalanges to the thumb. The convex ſide of this phalanx is very much flattened, and broader toward the head than toward the baſis. On the concave ſide is a kind of angular line, which,

Firſt phalanx of the thumb.

in ſome meaſure, diſtinguiſhes it into two parts. Its head is like thoſe of the metacarpal bones, only flattened at top.

716. The articular ſide of its baſis is proportioned to the digital ſide of the Os Trapezium of the carpus; and framed in ſuch a manner as that the ſigmoide cavities and eminences in both bones croſs each other. This articulation has ſomething very particular in it. It is a kind of double ginglymus which readily allows of flexion and extenſion, adduction and abduction, but with difficulty permits the oblique motions, becauſe then the two ſides run counter to each other.

717. The head and baſis carry for a long time the marks of epiphyſes; and for all theſe reaſons, this bone may be reckoned a metacarpal bone degenerated.

Second phalanx.

718. The ſecond phalanx of the thumb is ſhorter than the firſt; its body convex or ſemi-cylindrical on one ſide, flat on the other, and contracted between the edges. The articular ſide of the baſis is gently concave, and ſurrounded near the edges by ſmall tuberoſities, as alſo near the angle of the phalanx. The head is a regular portion of a pulley, which projects more on the concave than on the convex ſide; and on each ſide of it there is a ſmall foſſula, and ſome inequalities in form of tubercles. On the flat or concave ſide of the phalanx are two rough lines, one near each edge, which are often deſtroyed in cleaning the bones. They are the impreſſions or marks of the articular vaginæ, which ſhall be explained in deſcribing the freſh bones.

719. The connection of this phalanx with the firſt, is by a kind of arthrodia, or by a flat enarthroſis, which permits a motion in ſeveral directions, though more limited than in other articulations of the ſame kind. It is articulated with the third by a very perfect ginglymus.

Third phalanx.

720. The third phalanx of the thumb repreſents the half of a ſort of cone, cut lengthwiſe, and by joining it to the ſame bone of the other thumb, an entire cone is formed. The convex ſide is more even than the flat ſide, and on each edge, there is a tuberoſity near the baſis. The baſis has two hollow ſides, which form a ginglymus, with the head of the ſecond phalanx. The

head is ſmall and flat, ending in a rough ſemicircular border, which on the flat ſide of the bone repreſents a horſe-ſhoe.

The other four fingers.

721. The other four fingers in general, and their phalanges in particular, are all nearly of the ſame ſtructure, differing chiefly in ſize. The fore and ring-fingers are almoſt equal, only the fore-finger is generally a little bigger, and ſometimes a little ~~ſhorter~~ than the other. The middle finger is the longeſt, and the little finger the leaſt. Almoſt the ſame proportions are to be obſerved in the phalanges.

Firſt phalanges.

722. The firſt phalanges of theſe four fingers are made nearly in the ſame manner with the ſecond of the thumb; only they are longer in proportion, flatter on the concave ſides, and more rounded on the convex ſides. The edges of the flat ſides have the ſame rough line as the ſecond phalanx of the thumb. Their baſes are more hollow, for their articulation with the heads of the metacarpal bones, and their heads are like pulleys, as in the ſecond bone of the thumb.

Second phalanges.

723. The ſecond phalanges are ſhorter, narrower, and thinner than the firſt. Both phalanges are gently incurvated, and reſemble each other in ſtructure, except that the ſecond contract by degrees from their baſes to the heads, which are very ſmall; and that their baſes have a double cavity for their articulation by a ginglymus, with the heads of the firſt phalanges. Their flat ſides have the ſame rough lines already mentioned.

Third phalanges.

724. The third phalanges are in every thing like that of the thumb, except that they are ſmaller, each of them being proportioned to the fingers they belong to.

725. It is to be obſerved concerning all the phalanges, that their baſes have ſmall tuberoſitis, and their heads, except thoſe of the laſt phalanges, have on each ſide a roundiſh ſort of foſſula, bordered with ſmall eminences.

§ 9. *The particular ſituation and uſes of the bones of the upper extremity.*

726. The hand is generally repreſented in ſkeletons and figures as lying in the ſame plane, and in the ſame longitu-

dinal direction, with the bones of the fore-arm. This gives a very falſe idea of its true ſituation, which, with reſpect to the fore-arm, is oblique in two reſpects. The back of the hand is inclined upon the convex ſide of the carpus, and makes an angle with the fore-arm, and beſides, the fourth bone of the metacarpus is inclined towards the ulna in particular. In a word, the breadth of the hand makes an angle with the breadth of the fore arm, and the thickneſs of the hand at the ſame time with the thickneſs of the fore-arm. I mean here that part of the fore-arm which is next the hand.

727. This is owing to the ſtructure and ſituation of the bones of the carpus, and to their connection with thoſe of the fore-arm. Firſt, the two rows of theſe bones make a ſort of tranſverſe fold on the convex ſide of the carpus; and the articular brachial ſides of the two firſt bones of the firſt row are turned a little toward the ſame convex ſide of the carpus; which obliges the whole hand to be a little bent back in its natural ſituation. Secondly, the edge of theſe bones next the ulna is much ſhorter than that next the radius, which makes the cubital edge of the whole hand incline to that ſide.

728. By not conſidering this, a large void ſpace is commonly left in ſkeletons, between the extremity of the ulna and the Os Cuneiforme of the carpus. It ought likewiſe to be obſerved, that the edge of the metacarpus next the ulna is ſhorter than the other, ſo that in the metacarpus a ſmall and great edge may as juſtly be diſtinguiſhed, as in the carpus.

729. In this oblique and natural ſituation of the hand, the fingers being extended and a little ſeparated, the extremity of the fore-finger will be found to anſwer to the interſtice between the bones of the fore-arm; and if in this ſituation we make alternately the motions of pronation and ſupination, the extremity of the fore-finger will be found to be in ſome meaſure the common centre of theſe motions.

730. This diſpoſition of all the bones of the hand is moreover very well contrived, to give it ſeveral kinds of attitudes; for, by means thereof, it may be lengthened, flatted, ſhortened, and contracted. The hand is lengthened or widened, and flatted, by extending all the fingers and turning

back the thumb, which is what is called *extending* or *opening* the hand. It is ſhortened by bending all the fingers, whether in what is called *cloſing the fiſt*, or in graſping any thing; and to this the ſituation of the thumb, and the oblique diſpoſition of the bones of the metacarpus and fingers, contribute in a particular manner. And as in this caſe, the thumb counterbalances all the other fingers, the articulation of the firſt phalanx thereof with the Os Trapezium appears to be rendered more firm and ſteady, by partaking a little of the nature of a ginglymus, without hindering its other motions. Laſtly, the hand is contracted, and made into a ſort of gutter or furrow, by the adduction of the thumb, and the eaſy motion of the fourth metacarpal bone already mentioned. And if at the ſame time we bend the fingers and preſs them cloſe together, we both ſhorten and contract the hand, and thereby form a hollow, which is called *Diogenes's cup*.

731. In the fingers we ought likewiſe to remark, that though the articulation of the ſecond phalanx of the thumb and firſt phalanges of the other fingers be moveable in many directions, and framed nearly in the ſame manner as that of the Os Humeri with the ſcapula, yet theſe phalanges cannot be moved round their axes. This is not owing to their conformation, but to the want of proper muſcles, as we ſhall ſee afterwards. The ſame thing cannot be ſaid of the firſt phalanx of the thumb, becauſe though it had proper muſcles, yet the kind of half-ginglymus, by which it is articulated, would not allow of ſuch a motion.

732. The thumb is ſituated differently from the other fingers. The fingers, both with reſpect to their ſides and edges, have in their natural ſituation nearly the ſame direction with the plane of the metacarpus. The thumb being in its natural ſituation, and free from the action of all its muſcles, its convex ſide anſwers to the convex ſide of the radius, and its flat ſide is turned toward the little finger; and the firſt phalanx makes an hollow angle with the radius, and a prominent angle with the ſecond phalanx; but both this and the third phalanx lie in a ſtraight direction, like that of the fore-arm.

733. The carpus is the baſis and centre of all the motions of the hand, except that of rotation. By means thereof we can bend the hand in all directions, but with more eaſe

toward the ſides and edges, than any other way. The four bones of the ſecond row may have a ſmall degree of motion on the firſt, ſuch as a ginglymus can allow of.

734. The radius is in a manner the handle of the hand, and it is chiefly by means thereof, that we can move the hand reciprocally as on an axis, turning either edge of it toward the body. When the radial or great edge is turned to the body, this motion or attitude is termed *pronation*, and when the cubital or ſmall edge is toward the body, it is termed *ſupination*. In the natural and moſt ordinary ſituation of the hand, the palm is turned toward the body, and not the edges.

735. This diſpoſition of the hand determines the true ſituation of the radius, which is not on one ſide of the ulna in a parallel direction, as the figures and ſkeletons commonly repreſent it; but the radius croſſes the ulna obliquely in ſuch a manner, as that the ſtyloide apophyſes in both bones are directly over-againſt each other. This is its true natural ſituation. The radius being bent, may be ſtill further croſſed over the ulna, than in its natural ſituation, and this happens in pronation; but in ſupination it is parallel to the other bone.

736. The ulna ſupports the handle of the hand, without being itſelf articulated with the hand. Two lateral ginglymi and very ſtrong ligaments connect the radius cloſely with it, ſo that in the moſt violent motions theſe two bones cannot be ſeparated. When we puſh or preſs any thing with the hand, the whole force is ſuſtained by the radius, the baſis of which ſupports the wriſt, and its concave head is ſtrongly preſſed againſt the ſmall interior head of the Os Humeri. The oblique direction of the pulley of the ulna is the reaſon that in bending the fore-arm upward, the extremity of that bone is naturally turned towards the thorax, and not without difficulty toward the articulation of the ſcapula.

ART. V.

The bones of the lower extremities.

737. THE inferior extremities are two in number, ſituated laterally below the trunk, which both ſupports and is ſupported by them according to the different ſituations of the body. Each extremity is divided into the thigh, leg, and foot. In deſcribing the ſituation of all theſe bones, I ſuppoſe the ſubject to be ſtanding.

§ 1. *The Os Femoris.*

Size and figure. 738. The thigh-bone is the biggeſt and longeſt bone of the ſkeleton. Its figure comes near that of a cylinder, and it is a little bent at the middle.

Situation in general. 739. It lies in the ſame direction with the trunk; only a little obliquely, in ſuch a manner, as that the upper parts of the two bones are at a greater diſtance from each other than the lower.

Diviſion. 740. It is divided into the upper, middle, and lower parts, or into the body and two extremities.

Upper extremity. 741. In the upper extremity we are to conſider the head, neck, and two tuberoſities; one named *the great trochanter*, the other, *the little trochanter*.

742. The head is rounded like a portion of a globe or ball, and covered with a very ſmooth cartilage. Its ſituation is obliquely outward, and a little forward, ſo as that the greateſt portion of its convexity lies in the upper part, and the ſmalleſt in the lower part, and the cartilage extends further on the fore and back ſides, than on the other ſides.

743. A little below the middle of its convexity there is a foſſula nearly of a ſemilunar figure, in which a ligament is inſerted in the natural ſtate. This head is an epiphyſis in children, and in ſome ſubjects remains ſuch for a long time;

and is therefore liable to be ſeparated from the neck by any violent force.

744. The neck is an apophyſis, ſituated interiorly at the upper part of the bone being inclined upward, and a little forward, and making an angle with the body more or leſs oblique, but in ſome ſubjects it lies almoſt tranſverſely. Towards the lower part it expands into a kind of baſis; and at its middle narrow part, we obſerve a rough ſuperficial impreſſion, which ſurrounds it like a collar.

745. The great trochanter is a large tuberoſity lying on the exterior and a little toward the poſterior part of the baſis of the neck. It is very high, and turned a little backward, terminating in an obtuſe point in which there is a cavity or foſſula. Its convexity is unequal, and diſtinguiſhed into ſeveral ſurfaces, which are muſcular impreſſions; and the like impreſſions are found on its edge and concave ſide.

746. The little trochanter lies on the poſterior and inferior part of the baſis of the neck, being turned inward.

747. Between the two trochanters poſteriorly, there is an oblong, oblique eminence, which is a ſort of communication between them, and lengthens out the cavity behind the great trochanter. Anteriorly there is likewiſe a broad oblique line, ſometimes conſiderably raiſed, which runs between the two apophyſes, and terminates the baſis of the neck on the fore-part.

Lower extremity.

748. The lower extremity of the Os Femoris is broad and thick, being, as it were, the baſis of the whole bone. We obſerve in it two large articular eminences ſituated laterally with reſpect to each other, which are ſeparated, and very prominent on the backſide, but united like a pulley on the foreſide. They are called *condyles*; and with reſpect to the length of the body of the bone, the internal condyle is longer, and reaches lower than the other; but regard being had to the obliquity of the bone, there is very little difference between them, both lying nearly in the ſame horizontal plane.

749. The external condyle is broader, and advances more forward than the other. They are covered with a ſmooth cartilage, and though they both make but one body, they are in ſome meaſure diſtinguiſhed on the fore and lower ſides by

a ſuperficial depreſſion, after the manner of a pulley, and behind they are parted by a deep round foſſa.

750. In this large foſſa or notch there are ſeveral ſmall holes; and likewiſe two ſuperficial and pretty broad ſemilunar impreſſions, one at the lower edge of each condyle; that on the internal condyle being ſituated a little forward, and the other a little backward.

751. On the ſide of each condyle there is a tuberoſity, and behind that a muſcular impreſſion, together with a ſmall cartilaginous ſurface on which lies a kind of ſeſamoide bone, as we ſhall ſee in deſcribing the muſcles.

Body.

752. The body or middle portion of this bone repreſents a pillar or cylinder bent forward. We may however diſtinguiſh three ſides in it, one anterior, which is more rounded in the middle than in the upper and lower parts; and two poſterior, more flat than the former, and ſeparated by a long angular ridge, called *linea aſpera*, which is rough, unequal, and very prominent, and ſeems to ariſe from both trochanters. On the outſide of this ridge, toward its upper part, there is a rough longitudinal mark, a little depreſſed toward its lower extremity. Below the linea aſpera is divided into two, each running in the direction of the condyles; but being ſoon loſt after the diviſion, a flat triangular ſurface, very broad near the condyles, comes in its place. The external line is more prominent than the internal, till they both vaniſh.

753. There is likewiſe another oblique unequal line, before and under the little trochanter, which, as it deſcends, unites with the linea aſpera. All theſe lines, ridges, and depreſſions are for the inſertion of muſcles. About the middle of the bone on the back part we ſee ſometimes one hole, ſometimes more, for the paſſage of blood-veſſels and nerves.

Situation in particular.

754. The natural direction of the Os Femoris is not perpendicular, but oblique, the ſuperior extremity being inclined outward, the inferior extremity inward; ſo that the two bones, as has been already ſaid, are at a greater diſtance above than below; and from hence we ſee the reaſon why the internal condyle appears to reach lower down than the external, when we view a ſingle bone.

755. This bone is ſpungy at the extremities, and hollow in the middle; the cavity being filled with reticular ſubſtance and portions of laminæ detached from each ſide.

Subſtance.

756. It is articulated above by enarthroſis with the Os Innominatum, its head being received into the acetabulum; below, it is connected with the tibia by a particular kind of ginglymus, of which hereafter.

Connection.

§ 2. *The bones of the leg*; *and firſt*, *the Tibia.*

757. The leg is the ſecond part of the lower extremity, ſituated perpendicularly between the thigh and the foot, and conſiſting of two large bones called *Tibia* and *Fibula*, and a ſmall one called *Patella*.

758. The tibia is a long bone irregularly triangular, and much larger at top than below. Its name is taken from the reſemblance it bears to a kind of pipe or flute uſed by the ancients. It is divided into two extremities and a middle part, or into the head, body, and baſis.

Figure and diviſion of the tibia.

759. The upper extremity or head of the tibia conſiſts of two condyles, the upper ſide of which is flat and divided into two cartilaginous ſurfaces, almoſt horizontal, and a little hollow, one internal, the other external. Between theſe lies a cartilaginous tuberoſity, which appears to be double, and has inequalities both on the fore and back part, for the inſertion of ligaments. The two ſurfaces anſwer to the two condyles of the Os Femoris. The internal is ſomething oblong from before backward, and a little more depreſſed than the other. The external is rounder, and deſcends a little backward. The whole head taken tranſverſely is oval, except towards the back part, where there is a ſuperficial notch; and the circumference is very rough.

Upper extremity.

760. The external condyle is more prominent than the internal, and on its lower part, a little backward, there is a ſmall cartilaginous ſurface for the articulation of the fibula. On the fore part of the head there is an unequal tuberoſity,

called *the ſpine* of the tibia, for the inſertion of the tendinous ligament of the patella.

761. All that part of the head which lies above the level of the ſpine is epiphyſes in children; and the ſpine is originally an epiphyſis diſtinct from the other; but it afterwards becomes an apophyſis of the head of the tibia.

Lower extremity. 762. The lower extremity is neither ſo thick nor ſo broad as the upper. It may be looked upon as the baſis of the bone, and on its outſide there is a longitudinal depreſſion, broader at the lower than at the upper part, which receives the end of the fibula. On the inſide of the baſis there is an apophyſis called the *inner ancle*, which runs down lower than any other part, and has towards its poſterior ſide a groove or channel, for the paſſage of a particular tendon.

763. The baſis of the tibia terminates in a tranſverſe oblong cartilaginous articular cavity, the capacity of which is increaſed on the inſide by the inner ancle, the cartilage being likewiſe continued over that ſide of it, which is turned toward the cavity. Through the middle of this cavity a ſuperficial eminence runs, by which it is divided into a right and a left portion.

764. All the inferior portion of the baſis of the tibia, together with the ancle, is epiphyſes in children, and the marks thereof remain for a long time after the oſſification is perfected.

765. The greateſt breadth or longeſt diameter of the baſis of the tibia does not lie in the ſame plane with that of the head, the ancle lying a little more inward than the internal condyle. This obſervation is of great conſequence in fractures and luxations.

Body. 766. The body of the tibia is in a manner triangular, being diſtinguiſhed into three ſides, one internal, one external, and one poſterior; and into three angles, one anterior, called *the criſta* of the tibia, and two poſterior.

767. The inner ſide is the broadeſt of the three, very equal, gently convex, and turned a little forward. The outer ſide is unequally flat, and narrower than the former. The backſide is unequally rounded, and the narroweſt of all. At its upper part, however, it is of a conſiderable breadth, and

there we obſerve a long oblique muſcular impreſſion, beginning under the notch in the poſterior part of the head, and from thence running downward toward the inner ſide. Immediately below the extremity of this impreſſion there is another leſs oblique.

768. The anterior angle, called *criſta*, is ſharp, prominent about the middle, and almoſt round at the lower part. It might be reckoned a continuation of the tuberoſity or ſpine. The internal poſterior angle is ſomething rounded; the external is more acute, except toward the upper part, where it is more or leſs flatted.

Subſtance and connection.

769. The ſubſtance of the tibia is the ſame with that of the other long bones. It is connected above, with the condyles of the Os Femoris, by an articulation which is partly a ginglymus, for the extenſion and flexion of the leg, and partly an arthrodia for the rotation of the leg when bent. This is owing to two intermediate cartilages, which ſhall be examined in the deſcription of the freſh bones.

§ 3. *The Patella.*

Situation in general, figure, and ſize.

770. The patella is a ſmall bone, ſituated above the ſpine of the tibia, reſembling a large cheſnut. It is about half as thick as long, and its length and breadth are nearly equal.

Diviſion.

771. It is divided into a baſis, apex, and two ſides, one convex, the other concave. The baſis is the ſuperior, and thickeſt part of the bone, and is marked with a very conſiderable muſcular impreſſion, which runs down for a little way on the convex ſide. The apex is obtuſe, and ſerves for the inſertion of a ſtrong ligament, which ties the patella to the ſpine of the tibia.

772 The anterior ſide is convex, with ſome ſmall inequalities and furrows upon it. The poſterior ſide is concave, covered with a cartilage reaching near the apex, and terminating at an unequal cavity or foſſula, which is an impreſſion for the ligament already mentioned. This cartilaginous ſide is parted in two by a ridge which goes between the baſis and apex; and the two parts are exactly ſuited to the pulley of

the Os Femoris, the external part being broader than the internal, which is likewiſe obſerveable in the pulley.

773. The patella remains long cartilaginous, and in oſſifying, it becomes entirely cellulous, except the ſurfaces of its two ſides and the impreſſions.

Subſtance.

774. It is connected with the tuberoſity of the tibia by a thick ſtrong ligament, and indeed I look upon it as belonging in a particular manner to the tibia, or as a moveable olecranum, which again may be looked upon as a fixed patella. The reaſon of this difference in the two extremities ſhall be given in the hiſtory of the freſh bones and muſcles.

Connection.

§ 4. *The Fibula.*

775. The fibula is a ſmall long bone, irregularly triangular, lying on the outſide of the tibia, almoſt oppoſite to the external poſterior angle, but a little more backward. It is divided into the upper extremity or head, middle portion or body, and lower extremity or baſis.

Size, ſituation and diviſion.

776. The upper extremity is a kind of tuberoſity or head obliquely flatted by a ſmall cartilaginous plane, by which it is articulated with the cartilaginous ſurface at the lower part of the external condyle of the tibia. It terminates backward by a kind of ſhort blunt point directed upward.

777. The lower extremity is broader, flatter, and more oblong than the upper. It is partly a continuation of the body of the bone, and partly an epiphyſis in children, the marks of which are quite loſt in an advanced age. It has, in a manner, three ſides, one rounded like a tuberoſity, one flat, and the third narrow. When it is placed in the lateral cavity of the baſis of the tibia, it makes the outer ancle oppoſite to the inner ancle. In its natural ſituation it reaches much lower down than the baſis of the tibia, and ends in a point turned a little backward.

778. The flat ſide is cartilaginous, and turned toward the cartilaginous ſide of the inner ancle, with which, and with the inferior ſide of the baſis of the tibia, it completely forms the cavity by which the leg is articulated with the foot. The

narrow ſide is turned backward, and near its lower part is a ſmall oblong unequal foſſula, formerly believed to be for the paſſage of a tendon, in which a ſmall mucilaginous gland is lodged. The point by which the baſis of the fibula ends has a ſmall ſmooth ſurface immediately below the narrow ſide, for the inſertion of an annular ligament.

779. The body of this bone is long and ſmall, more or leſs contorted, and irregularly triangular. Near the two extremities it contracts into a kind of neck, and a little below the middle it is often bent inwards; but this curvature ſeems chiefly owing to the method of dreſſing children, for we ſometimes meet with this bone very ſtraight. It is diſtinguiſhed in an irregular manner into three ſides, and three angles principally towards its lower part.

780. The outſide is the moſt conſiderable. The upper half of it is more or leſs hollow; afterwards it grows round, and altering its direction, becomes almoſt poſterior in the lower half. The poſterior ſide is more or leſs convex toward the upper part; then it grows flat, and turning in the ſame manner as the former, becomes nearly internal toward the lower part. The inner ſide has likewiſe a turn below its middle, and becomes anterior from thence downward; and this turn is marked by an oblique line which runs down on this ſide from behind forward, and divides it into two. Theſe ſides ſerve partly for muſcles to lie upon, and partly for their inſertions.

781. The internal angle of the fibula anſwers to the external poſterior angle of the tibia, and both ſerve for the inſertion of the interoſſeous ligament of the leg. The other two angles are more or leſs ſharp, eſpecially the anterior, which is ſometimes like a kind of criſta, and terminates below, in a ſmall triangular ſurface.

782. The internal ſtructure of the fibula, though a very ſmall bone, is like that of the other long bones.

Subſtance and connection.

It is articulated by its upper extremity with the inferior ſurface of the external condyle of the tibia. This articulation is an arthrodia with a very ſmall degree of motion. The inferior extremity is articulated by its cartilaginous ſide, partly with the lateral depreſſion in the baſis of the tibia, in the manner that ſhall be explained in the hiſtory of the freſh bones, and partly with the firſt bone of the foot, completing the ginglymus between the leg and that bone.

§ 5. *The bones of the foot; and firſt, the bones of the Tarſus.*

783. The foot is the third portion of the lower extremity, and is divided into three parts, the tarſus, metatarſus, and toes. The vulgar mention ſeveral other parts of the foot, ſuch as the heel, the point, the upper part, the ſole, the ſides or edges, one internal, the other external, *&c.*

784. The tarſus conſiſts of ſeven bones, much larger than thoſe of the carpus, the names for which, in the order in which they are commonly deſcribed, are *the Aſtragalus, Os Calcis, Os Scaphoides, Os Cuboides*, and three *Oſſa Cuneiformia.* According to their ſize they may be divided into three claſſes of large, middle-ſized, and ſmall bones. The Aſtragulus and Os Calcis belong to the firſt claſs; the Os Scaphoides and os Cuboides to the ſecond; and the three Oſſa Cuneiformia to the third.

785. The particular diviſions of each of theſe bones, and indeed of all the bones of the foot, are much more eaſy than in the bones of the hand, becauſe the foot remains always in the ſame attitude; and therefore the anterior, poſterior, ſuperior, inferior, lateral, and other parts may be certainly fixed, without any danger of miſtaking.

Aſtragulus.

786. According to the natural ſituation of the foot, and its connection with the leg, the aſtragulus is the ſuperior and firſt bone of it. This bone may be divided into two portions, one large and poſterior, which is, as it were, the body of the bone; and one ſmall and anterior, which is an apophyſis or the anterior portion.

787. The body or poſterior portion has four ſides, one ſuperior, two lateral, and one inferior. The upper ſide is the largeſt, covered all over with a cartilage, cylindrically convex from before backward, with a depreſſion running through the middle of its breadth, which repreſents half a pully, and continuous with the two lateral cartilaginous ſides, of which the external is broader than the other. This upper ſide is articulated with the lower ſide of the baſis of the tibia, the internal lateral ſide, with the inner ancle, and the external lateral ſide with the outer ancle. Below the inter-

nal lateral ſide there is a great depreſſion without cartilage, and ſeveral other inequalities.

788. The lower ſide is likewiſe cartilaginous and obliquely concave, for its articulation with the Os Calcis. At the very loweſt and poſterior part of the body of the aſtragalus, on the edge of the lower ſide, is a ſmall, oblique, ſmooth notch or channel for the paſſage of tendons.

789. The apophyſis or anterior part of the aſtragalus, is diſtinguiſhed from the body by a ſmall depreſſion on the upper part, and on the lower, by a long, oblique, unequal notch, very broad toward the outſide. The anterior ſide of this apophyſis is all cartilaginous and obliquely convex, for its articulation with the Os Scaphoides. The lower ſide likewiſe cartilaginous is parted in two, and articulated with the Os Calcis, being diſtinguiſhed from the lower ſide of the body of the bone by the long oblique notch already mentioned. Beſides theſe two cartilaginous ſides there is a third below the anterior, towards the inner part, which in the ſkeleton touches nothing.

Os Calcis.

790. The Os Calcis is the largeſt bone of the foot, of which it makes the poſterior part, and, in ſome meaſure, the baſis. It is oblong and very irregular, and may be divided into a body and two apophyſes, one great and anterior, the other ſmall, lateral and internal.

791. The body of the Os Calcis has ſix ſides, one poſterior, one anterior, one ſuperior, one inferior, and two lateral.

792. The poſterior ſide is broad, unequally convex, and as it were divided into two portions, one ſuperior, ſmall, and poliſhed; the other inferior, much larger, unequal, and rough, which in children is an epiphyſis; and may be named the *tuberoſity* of the Os Calcis. The lower part of it is bent downward, and terminates in two tubercles or obtuſe points, which belong rather to the inferior than to the poſterior ſide of the bone.

793. The upper ſide may be divided into two parts, one poſterior and unequal, having a ſmall depreſſion; the other anterior, convex, and cartilaginous, proportioned to the great inferior cavity of the aſtragalus. This ſide is turned obliquely forward, and by this obliquity becomes part of the

foreſide, the remaining part of which is loſt in the anterior apophyſis.

794. The lower ſide is narrow, and behind it lie the two tubercles already mentioned, of which the internal is the biggeſt. They both ſerve for the inſertion of the aponeuroſis in the ſole of the foot, but chiefly the biggeſt.

795. The two lateral ſides are continued over the anterior apophyſis. The external is gently convex and unequal, covered only by the common integuments and ligaments. The internal is hollowed and depreſſed.

796. The great or anterior apophyſis lies in the ſame direction with the body, being a continuation thereof. It has five ſides or remarkable parts, and were it not for the body, it would have a ſixth.

797. The upper ſide has an irregular and unequal depreſſion, which together with that in the apophyſis of the aſtragalus forms a conſiderable foſſula. At its anterior extremity there is a ſmall cartilaginous ſurface anſwering to one of thoſe in the apophyſis of the aſtragalus.

798. The anterior ſide of the apophyſis is broad, oblique, cartilaginous, partly convex and partly concave, and articulated with a like ſurface of the Os Cuboides. This is the foreſide of the whole Os Calcis when conſidered without any diviſion.

799. The outſide of the apophyſis is very rough, being a continuation of the outer ſide of the body, with a tubercle or eminence at the place where theſe two ſides meet, which, however, is not found in all ſubjects. On the lower part of this tubercle, is a cartilaginous ſurface for the paſſage of the tendon of the peronæus longus. Sometimes we ſee only ſome ſmall veſtiges of this eminence, and often none at all. We ſometimes meet with another ſmall cartilaginous ſurface lower down and more forward, near the anterior extremity of the apophyſis, for the paſſage of the ſame tendon.

800. The lower ſide is a tuberoſity continued from the ſide of the body, and deſigned for the inſertion of muſcles.

801. The lateral apophyſis is almoſt common to the body, and to the great anterior apophyſis, and increaſes the cavity on the inſide of the Os Calcis. On its upper part, it has a very ſmooth cartilaginous ſurface articulated with one of the inferior ſurfaces of the aſtragalus. This apophyſis is very

low down, and its inferior part is ſmooth for the paſſage of tendons.

802. The Os Scaphoides, called alſo *Os Naviculare* from its reſemblance to a little flat boat, lies before the aſtragalus. It has two cartilaginous ſides, an oval circumference, and a tuberoſity. Its thickneſs is inconſiderable when compared with its other dimenſions, and it lies as it were on its ſide, before the aſtragalus.

Os Scaphoides.

803. The concave ſide is poſterior, articulated with the anterior convex ſide of the aſtragalus. The anterior convex ſide is divided by two ſmall lines into three planes for the articulation of the three Oſſa Cuneiformia.

804. The circumference forms an oval, which contracts by ſmall degrees, and terminates in an obtuſe point. One ſide of this circumference is more convex and rough than the other, and the inequalities in it ſerve for the inſertion of ligaments. The point of the oval ends in a tuberoſity marked with a muſcular impreſſion. In the natural ſituation of this bone, the moſt convex ſide is uppermoſt, the other, loweſt, and the tuberoſity turned inward and downward.

805. By this ſituation, and the difference of the ſides, it is eaſy to diſtinguiſh the Os Naviculare of the right foot from that of the left. The ſmall or inferior convexity of the circumference has, near the tuberoſity, a ſuperficial notch, and on the oppoſite ſide, a ſmall cartilaginous ſurface, and a ſmall tubercle for its articulation with the Os Cuboides, and the inſertion of ligaments.

806. The Os Cuboides is ſituated before the Os Calcis, on one ſide of the Os Scaphoides. It is a maſs with ſix ſides, all very unequal and very irregular; and from theſe it has its name.

Os Cuboides.

807. The upper ſide is flat and rough, for the inſertion of the ligaments which connect it with the neighbouring bones.

808. The lower ſide has an oblique eminence, and immediately below that, a canal or groove which is likewiſe oblique. The eminence divides this ſide into two, and is a little cartilaginous on that edge which touches the groove. The groove appears to be cartilaginous from a ligament which lines it, and both that and the edge of the eminence ſerve

for the inſertion of an annular ligament, and for the paſſage of the tendon of the peronæus longus.

809. The poſterior ſide is cartilaginous, broad, oblique, partly convex and partly concave, anſwering to the anterior ſide of the Os Calcis.

810. The anterior ſide is pretty broad, and divided into two portions by a narrow prominent line, by which portions this bone is articulated with the third and fourth bones of the metatarſus.

811. The inner ſide is the longeſt of all. It has a ſmall cartilaginous ſurface, by which it is articulated with one of the Oſſa Cuneiformia. The reſt is rough, with ſeveral depreſſions, in which veſſels and glands are lodged. Behind the cartilaginous portion, there is in ſome ſubjects another narrow ſurface, which is articulated with the neighbouring portion of the circumference of the Os Scaphoides; this articulation, when wanting, is ſupplied by ligaments.

812. The outſide is the leaſt of all, irregular, ſhort, and narrow, and it has a notch which communicates with the groove on the lower ſide.

Oſſa Cuneiformia.

813. The Oſſa Cuneiformia, are three in number, ſituated before the Os Scaphoides, and they have their name from the reſemblance they bear to wedges. The firſt is the largeſt, the third the leaſt; and the ſecond of a middle ſize between the other two With the Os Cuboides they form a ſort of arch which on the ſide next the other foot is high, and low on the oppoſite ſide.

814. In each bone we may diſtinguiſh the baſis, apex, and four ſides, one poſterior, one anterior, and two lateral, whereof one is internal, the other external.

815. The firſt bone is like a wedge contorted and bent. Its baſis is low down, unequally rounded, like an oblong tuberoſity, ſerving for the inſertion of a tendon.

816. The internal lateral ſide, or that which is turned toward the other foot, is unequally convex and rough for the inſertion of ligaments.

817. The external lateral ſide, or that next the ſecond bone, is unequally concave, and cartilaginous toward the ſuperior and poſterior edges. The largeſt portion of this ſide is articulated with the ſecond bone; the reſt toward the an-

terior edge is joined laterally to the ſecond bone of the metatarſus.

818. The backſide is the leaſt, cartilaginous, and almoſt triangular, ſuited to the firſt of the three triangular ſurfaces of the Os Scaphoides.

819. The anterior ſide is cartilaginous, large, and ſemilunar, the convex edge being turned to the other foot, and by this, the firſt Os Cuneiforme is articulated with the firſt bone of the metatarſus.

820. The angle is turned upward, and the obliquity thereof occaſions the anterior ſide to be the higheſt, and the poſterior, the loweſt.

821. The ſecond Os Cuneiforme, the leaſt of the three, has the baſis upward, and the angle downward, and reſembles a wedge more than the firſt. Its baſis is ſhort and rough for the inſertion of ligaments. The backſide is cartilaginous, and perfectly triangular, ſuited to its articulation with the middle ſurface of the convex ſide of the Os Scaphoides. The anterior ſide is alſo cartilaginous, a little more oblong, and articulated with the baſis of the ſecond metatarſal bone.

822. The two lateral ſides have, toward their ſuperior and poſterior edges, oblong cartilaginous ſurfaces, by which they are articulated with the firſt and third Oſſa Cuneiformia. The reſt of theſe two ſides is a little depreſſed, and thereby ſmall interſtices or void ſpaces are left between the bones. This is every way the ſhorteſt bone of the three. Its angle is hid between the other two bones of the ſame name, and does not reach ſo low as theirs, which makes this part of the foot a little hollow.

823. The third Os Cuneiforme, of a middle ſize between the other two, has likewiſe its baſis upward and its angle downward. The baſis is longer than that of the ſecond, almoſt flat or very little convex, and rough for the inſertion of ligaments. The angle runs down lower than that of the ſecond bone.

824. The backſide is cartilaginous and triangular, that is, of the ſame figure with the third ſurface of the convex ſide of the Os Scaphoides. The anterior ſide is likewiſe cartilaginous and triangular, but a little oblong, being articulated with the baſis of the third bone of the metatarſus.

825. The internal lateral ſide is broad, with two cartila-

ginous ſurfaces, one toward the poſterior edge, the other toward the anterior. The firſt is for its lateral articulation with the ſecond Os Cuneiforme, the ſecond for its lateral articulation with the baſis of the ſecond metatarſal bone.

826. The external lateral ſide is likewiſe broad, and toward its poſterior edge has a large cartilaginous ſurface for its articulation with the Os Cuboides. Towards its anterior edge there is a ſort of void ſpace for the paſſage of veſſels, and ſometimes a little cartilaginous corner for its lateral articulation with the fourth bone of the metatarſus.

§ 6. *The bones of the Metatarſus.*

827. The metatarſus is the ſecond part of the foot; and in ſome things it agrees with the metacarpus, and differs from it in others. It conſiſts of five bones, whereas the metacarpus is reckoned to conſiſt only of four, and it forms a ſort of grate, inclined in the ſame manner with the arch of the Os Cuboides and Oſſa Cuneiformia. Theſe bones are diſtinguiſhed only by the names of *firſt*, *ſecond*, &c. and to them we may add two ſeſamoide bones commonly preſerved in the ſkeleton, which belong to the great toe.

828. The bones of the metatarſus, like thoſe of the metacarpus, may be divided into two extremities, and a middle part; or into the head, baſis, and body. The heads are ſituated forward, the baſes backward, and both are cartilaginous as in the hand. The bodies are triangular, but diſpoſed in ſuch a manner as that the parts called *external* and *internal* in the hand, are here the ſuperior and inferior.

829. The firſt of the five metatarſal bones is the biggeſt and ſhorteſt of all. The four following are proportionably longer than in the hand, and their baſes larger than the heads; ſo that, in their natural ſituation, the baſes take up a greater ſpace than the heads. The heads terminate, towards the ſole of the foot, by two ſmall productions, as in the hand. In theſe four bones the inferior angles of their bodies are turned obliquely outward, and their heads do not lie altogether in the ſame direction with their bodies. The baſis of the firſt bone, and the heads of the other four, remain for a long time epiphyſes; of which there are likewiſe ſome marks in the head of the firſt.

830. The baſis of the firſt bone of the metatarſus has a ſemilunar circumference, the flat ſide being turned outward or toward the ſecond bone of the ſame foot, and the convex ſide inward, or toward the other foot. One point of the creſcent is turned upward, the other downward; and the whole baſis is gently hollow, but broader toward the upper than toward the lower part. At the external edge or flat ſide of the baſis, there is often a cartilaginous ſurface for its lateral articulation with the baſis of the ſecond bone; and at the lower part of the ſame ſide, preciſely at the inferior point of the creſcent, there is a very remarkable and very conſtant muſcular impreſſion for the inſertion of the tendon of the peronæus longus. The circumference of the baſis is a little raiſed, like a flat roll.

Firſt bone.

831. The head of this bone is thick, cartilaginous, and convex on the fore and lower part, but with this difference, that the convexity on the fore part is ſimple and even, but on the lower, reſembles a double pulley, having two cavities and three eminences, *viz.* two edges, a channel near each edge, and an eminence between the two channels. The convexity in general is for the articulation of this bone with the firſt phalanx of the great toe, and the double pulley for that of the two ſeſamoide bones already mentioned, and which ſhall be deſcribed after the toes.

832. The body of the bone is triangular, and very big, having three ſides, two ſuperior and one inferior. One of the ſuperior ſides is internal and rounded, the other external and gently concave, and the inferior ſide is flat. It has likewiſe three angles, one ſuperior, and two inferior, one internal, the other external; on the lower part of which we ſee a ſort of continuation of the tendinous impreſſion of the peronæus longus.

833. The ſecond bone of the metatarſus is the biggeſt of all. Its baſis is large, triangular, and a little oblique, and the principal cartilaginous or articular ſide thereof is obliquely triangular, anſwering to the anterior ſide of the ſecond Os Cuneiforme. On each ſide, near the baſis, there is a cartilaginous ſurface for its articulations with the firſt and third Oſſa Cuneiformia, between which this bone appears to be fixed.

Second bone.

834. Beſides theſe lateral ſurfaces, there are others on the

anterior and upper part of the baſis for its lateral articulations with the baſis of the firſt and third bones of the metatarſus; ſo that this ſecond bone is articulated with five others, *viz* backward with the ſecond Os Cuneiforme, on one ſide with the firſt Os Cuneiforme, and firſt bone of the metatarſus, and on the other ſide with the third Os Cuneiforme and third bone of the metatarſus.

835. Its head is rounded, and reſembles pretty much that of the firſt bone of the metacarpus, having tubercles, points, *&c.* in the ſame manner.

836. The body is long and obliquely triangular, the angle that makes the hollow of the foot, being turned obliquely outward. The reſt is proportionably as in the metacarpus.

Third and fourth bones.

837. The third bone of the metatarſus is ſmaller than the ſecond, and the baſis of this and of the fourth bone very narrow; and indeed theſe two bones are very much alike. The third is conſiderably leſs than the ſecond, but the fourth is very little leſs than the third.

838. The baſis of the third is deepeſt, conformably to its articulation with the anterior ſide of the third Os Cuneiforme. Beſides this poſterior ſide, it has lateral ſurfaces for its articulation with the third and fifth bones of the metatarſus.

839. The baſis of the fourth bone is broader and ſhorter than that of the third, and articulated with one portion of the anterior ſide of the Os Cuboides. In every thing elſe it reſembles the reſt.

Fifth bone.

840. The fifth bone of the metatarſus has ſomething peculiar. Its baſis is tranſverſely broader than it is thick or high, being very oblique, and terminating by a tuberoſity and point which lie a great way out of the plane of the baſis. The tuberoſity is turned outward, and the point quite backward. The principal ſide is oblique, anſwerably to that of the ſecond portion of the anterior ſide of the Os Cuboides.

841. There is likewiſe an internal lateral ſurface, articulated with the baſis of the fourth bone. The tuberoſity and point ſerve for the inſertion of the peronæus medius. The poſterior part of the bone is expanded proportionably to the baſis, ſo that this bone is obliquely pyramidal; and the

tuberoſity reaches to the ground, in the natural ſituation of a foot which has not been ſpoiled by high-heeled ſhoes.

§ 7. *The bones of the toes.*

842. The toes make the third part of the foot, and terminate the whole inferior extremity, and with that the whole body. They are five in number on each foot, called *the great toe*, *the ſecond*, *third*, *fourth*, and the *little toe.* The figure of them is ſomething like that of the fingers.

843. Each of the toes, except the great one, conſiſts of three phalanges; the great toe has but two, whereas the thumb has three; but then there are five metatarſal bones in the foot, and but four metacarpal bones in the hand. The baſes of the phalanges remain for as long a time epiphyſes as thoſe of the hand.

The great toe.

844. The great toe is very thick and big, whereas the other toes are very ſmall in proportion to the fingers.

845. The firſt phalanx of the great toe is pretty like the ſecond of the thumb, but its baſis is more hollow, anſwerable to the convexity of the firſt bone of the metatarſus, by which it is ſupported. Its head is in form of a pulley, as in the thumb, but much broader.

846. The ſecond or laſt phalanx of the great toe is like the third of the thumb, but bigger and broader, eſpecially at the baſis. The tuberoſity in the ſhape of a horſe-ſhoe, which terminates this bone, is more unequal and more flat than in the thumb.

The other four toes.

847. The other four toes are very ſmall when compared with the great one. The firſt phalanges are the longeſt, but they are ſhorter and more convex an thoſe of the fingers. Their bodies are very narrow, and contracted in the middle. The baſes are generally excavated, and the heads made after the ſame manner as in the fingers.

848. The ſecond phalanges are very ſhort, and almoſt without ſhape. Both their baſes and heads are formed for articulations by ginglymi, but they are very imperfect. The bodies are of ſome length in the ſecond and third toes, but

they are very ſhort in the other two, eſpecially in the little toe, the body of which is broader than it is long.

849. The third phalanges are nearly of the ſame figure with thoſe of the fingers, but much ſhorter and thicker in proportion. In the two laſt toes they are often united with the ſecond phalanges, which is owing perhaps to the continual inaction and compreſſion occaſioned by the ſhoes.

Seſamoide bones.

850. The ſeſamoide bones in general are very ſmall, being denominated from a ſeed to which they are ſuppoſed to bear a reſemblance. Several ſuch bones are found in the joints both of the toes and fingers; but as they are for the moſt part very ſmall, and fixed chiefly to ligaments, it will be more proper to ſpeak of them in the deſcription of the freſh bones.

851. Two of them, however, are big enough to be preſerved in ſkeletons. They reſemble a large flat oval pearl, hollowed on one ſide.

852. They are about the third part of an inch in length, and half as broad as long; and they are connected very near each other, by a ſmall ſhort ligament, to the baſis of the firſt phalanx of the great toe, ſo as to ſlide on each ſide of the middle eminence of the double pulley in the firſt metatarſal bone, like two ſmall patellæ.

853. Though they are generally faſtened, in ſkeletons, to the firſt bone of the metatarſus, they nevertheleſs belong only to the firſt phalanx of the great toe, as the patella belongs not to the Os Femoris, but to the tibia. I ſhall have occaſion to ſay ſomething more about them in the hiſtory of the freſh bones.

§ 8. *Mechaniſm and uſe of all the bones of the lower extremity.*

854. The articulation of the Os Femoris with the Os Innominatum, being by enarthroſis, that is, the ſpherical head of the thigh-bone being lodged in the acetabulum, the thigh is diſpoſed to be moved in all directions. We can carry it forward and backward, nearer the other thigh, or to a greater diſtance from it; and theſe four motions may be rendered more or leſs oblique, and thus the number of them may be multiplied according to the different degrees of obliquity.

855. All theſe motions may likewiſe be combined in ſuch a manner, as that the lower extremity of the bone ſhall deſcribe a ſort of circumference, while the head moves only round a centre.

856. The Os Femoris may alſo have another kind of motion, called by anatomiſts, *rotation*, though very improperly. By this motion they underſtand two reciprocal half-turns, that is, in oppoſite directions to each other, which the thigh is capable of making round an axis, which they take for the axis of the bone; but it is very evident, if we conſider the obliquity of the neck, that this motion is not round the axis of the bone, but round a line drawn from the head, to the middle of the pulley at the lower extremity, when the ſubject is ſuppoſed to be ſtanding.

857. We are likewiſe to obſerve, that by this rotation of the Os Femoris, the neck and great trochanter are moved ſimply backward and forward, whereas when the bone is moved directly forward or backward, the neck moves more or leſs round its axis, eſpecially if at the ſame time the bone be held at ſome diſtance from the other.

858. All theſe motions of the Os Femoris are differently limited by the ſtructure of its articulation, and eſpecially by that of the acetabulum; and likewiſe pretty much by the ſituation of the head on the ſuperior extremity of the bone. In a word, the depth and obliquity of this articulation render the mechaniſm thereof very particular, and it is of the greateſt conſequence to be well acquainted with it in caſes of luxations and fractures. The following obſervations will be ſufficient to give a true idea of it.

859. The thigh ought to ſupport firmly the weight of the whole body when we ſtand or kneel; and that in all the different attitudes or changes of ſituation, that is, whether the trunk be ſtraight, inclined, or turned, and even with the addition of a conſiderable load.

860. The thigh is moveable in all directions, but the motion of flexion is the greateſt of all, whether we ſtand or ſit; that of adduction is likewiſe conſiderable, eſpecially when the thigh is bent. Theſe two motions are more frequent, as well as of a greater extent than the reſt; for it is chiefly by them that the body is carried from one place to

another; and alſo put in ſeveral ordinary and neceſſary ſituations, whether in ſtanding, ſitting, or lying.

861. Theſe two general diſpoſitions are founded on the depth and obliquity of the articulation. By the firſt, the thigh becomes able to ſupport the body in all the attitudes already mentioned, and by the ſecond the principal motions are made eaſy.

862. The acetabulum or cotyloide cavity is deeper on the upper and back part than on the lower and fore part; and it is at theſe two places, or in the middle ſpace between them, that the body is ſuſtained, according as it is in an erect or inclined poſture. The ſtructure of the head of the Os Femoris is exactly ſuited to theſe ſupporting points in the acetabulum, its cartilaginous convexity being larger on the upper part than any where elſe.

863. The acetabulum is ſhallow on the fore and lower parts, not only becauſe theſe parts are leſs neceſſary for ſupporting the body, but alſo becauſe a proviſion is thus made for the obliquity of the articulation, without which the thigh could not without great difficulty have been bent, or carried inwards or over the other thigh. The obliquity of the cotyloide cavity facilitates the motion of adduction, and the obliquity of the head of the Os Femoris facilitates and enlarges the motion of flexion.

864. In the motion of adduction, part of the head of the bone goes out of the cavity, and that in two different ways. When we ſtand or lie at full length, and in theſe poſtures ſeparate the thighs from each other, the head goes out at the lower part of the cavity; but when we ſit or lie on our backs, with the thighs raiſed, and ſeparate the thighs, it goes out on the fore part.

865. The motion, called *rotation*, varies according as the thigh is extended or bent. The rotation of the thigh when extended, brings the head of the Os Femoris either forward or backward. When the head is carried backward, the neck ſtrikes againſt the poſterior edge of the acetabulum, and a large portion of the head goes out at the anterior part of the cavity; but when the head is carried forward, a very ſmall portion of it goes out of the cavity, becauſe of the depth of the edge at the back part, and the neck does not ſtrike againſt the anterior edge, which is very low. In the rotation of the thigh

when bent, the head is brought upwards and downward, and goes leſs out of the cavity above than below.

866. The articulation of the tibia with the Os Femoris is of a very ſingular nature. In the flexion and extenſion of the tibia it is a ginglymus, but there is ſomething more in it ſtill, by which the leg becomes capable of having a rotation independent of that of the thigh. This double mechaniſm depends on the ſemilunar cartilages, and therefore muſt be referred to the decription of the freſh bones. It will be ſufficient in this place to make that motion be conceived, which I term *the rotation of the leg* when bent; becauſe in that caſe only, it is poſſible, and we ſee it evidently, when, ſitting and preſſing the heel againſt the ground, we turn the toes alternately outward and inward.

867. We then obſerve, that the whole leg makes reciprocal half-turns independently of the thigh; and if at the ſame time we put our hand upon the knee, and then graſp the joint with our fingers, we feel the head of the tibia to move in the ſame manner, while the extremity of the Os Femoris remains at reſt.

868. And if we examine attentively, we ſhall find, that the centre of this motion is rather in the inner cavity of the head of the tibia, than in the middle ſpace between the two cavities; for we feel diſtinctly that the external part of the head of the tibia moves backward and forward, while the internal turns almoſt wholly round its axis.

869. We may therefore diſtinguiſh three ſorts of motion in this joint, that of flexion and extenſion, the rotation of the internal part of the head of the tibia upon an axis, and a kind of arthrodial motion of the external part of the ſame head.

870. I look upon the patella as a piece belonging as really and peculiarly to the tibia, as the olecranum does to the ulna; becauſe it is of the ſame uſes with reſpect to that bone, as the olecranum is of to the other. They both ſerve to facilitate the action of the extenſor muſcles, by placing their direction at a greater diſtance from the centre of motion of the joint.

871. They both ſerve to defend the tendons of the muſcles fromt he compreſſions, contuſions, and ruptures which they would otherwiſe be ſubject to in great efforts, did they

paſs over the ſharp edges of the bones; and laſtly, they ſecure theſe tendons from the like accidents when the joints ſtrike againſt or preſs upon any hard body, as when we lean on the elbow, or kneel; or when the elbow or knee receive any external injury from ſtrokes, *&c.*

872. The difference between the patella and olecranum lies in this, that one is immoveable, making but one piece with the ulna, the other is moveable, being a piece diſtinct from the tibia. The immobility of the Olecranum ſtrengthens and ſecures the articulation of the ulna with the Os Humeri, which is deſigned only for flexion and extenſion.

873. For the ſame reaſon the patella would have been immoveable, had the articulation of the tibia with the Os Femoris been contrived for theſe two motions alone; and eſpecially becauſe the extenſor muſcles of the tibia are very often expoſed to greater efforts in ſupporting the weight of almoſt the whole body, ſometimes increaſed by that of a conſiderable burden.

874. The rotation of the leg when bent is the ſole cauſe of this difference; becauſe, had the patella been immoveably joined to the tibia, the leg could never have made theſe half-turns, without either a luxation, or fracture of the patella. The olecranum may therefore be looked upon as an immoveable patella, and the patella as a moveable olecranum.

875. The fibula is articulated by its upper extremity, with the lower ſurface of the external condyle of the head of the tibia. This is an obſcure arthrodia, and ſuffers the head of the fibula only to ſlide a little forward and backward; the only deſign of which ſmall degree of motion ſeems to be, that the fibula, in which many muſcles of the foot are inſerted, may have liberty to yield a little in the violent efforts of theſe muſcles, as in running much, jumping, or walking under a heavy burden, as we ſhall ſee in the expoſition of the muſcles.

876. This bone is likewiſe joined to the tibia by its lower extremity, and makes the outer ancle; but this connection is chiefly ligamentary, as ſhall be ſhewn in the deſcription of the freſh bones. The upper edge of the cartilaginous ſurface of this extremity is articulated at the lower part of the lateral depreſſion of the tibia, with a narrow cartilaginous

border, which is nothing but the thick edge of the cartilage at the baſis of that bone.

877. The extremities of theſe two bones touch each other likewiſe a little by their bony portions, near the cartilages. The articulation, reſulting from theſe two ſorts of connection, has but a very ſmall extent, and ſeems to be partly a ſynarthroſis, partly a diarthroſis; that is, a ſort of amphiarthroſis or doubtful articulation, almoſt without any motion, except what is neceſſary to make it the centre of motion of the upper extremity of the fibula.

878. The cartilaginous ſide of the external ancle or lower extremity of the fibula completes the cavity, by which the leg is joined to the foot, and contributes more to that than the internal ancle.

879. The crookedneſs frequently obſerved in the fibula, below the middle or at about two thirds of its length, does not ſeem to be natural, (becauſe we ſometimes meet with this bone perfectly ſtraight), but to be rather owing to the manner of dreſſing children, this being the place at which they are ſwaddled very tight.

880. The fibula is not ſituated directly on the outſide of the tibia, but a little more backward; ſo that having placed the two legs of a ſkeleton in their natural erect poſture, a pretty thick rod might be paſſed between the two tibiæ and fibulæ without changing the ſituation of the legs.

881. The foot is articulated with the leg, by the aſtragalus alone. This articulation is a true angular ginglymus, and confined entirely to the motions of flexion and extenſion.

882. It is commonly thought that two other motions are likewiſe performed by means of this articulation, *viz.* that of turning the toes inward or outward, and that of the lateral flexion of the foot, or the turning the ſole of the foot toward either ancle. But neither of theſe motions depend on the articulation of the foot with the leg, as the ſtructure of the parts, and juſt obſervations evidently ſhew.

883. The articulation of the aſtragalus with the ſeveral ſurfaces of the Os Calcis is a kind of obſcure arthrodia, as well as thoſe of the other bones of the tarſus with each other. By theſe articulations, the foot not being ſupported, makes the ſmall lateral motions already mentioned; but when the toes are turned outward or inward independently of the tibia,

bia, the Os Calcis makes ſmall half-rotations under the aſtragalus, and obliges the Os Scaphoides to ſlide in the ſame direction with it on the anterior ſide of the aſtragalus; and this motion of theſe two bones is communicated to all the reſt.

884. It is by the articulation of the Os Scaphoides with the aſtragalus, that the ſmall lateral flexions of the foot are performed, *viz.* when the ſole of one foot is turned toward the other foot, or the contrary way. In this caſe the Os Scaphoides makes ſmall rotations on the anterior ſide of the aſtragalus, while the Os Cuboides ſlides up and down on the foreſide of the great apophyſis of the Os Calcis. The obliquity of the articular ſurfaces of theſe two bones is perfectly ſuitable to ſuch a motion. In theſe motions the Os Calcis and aſtragalus are in a manner immoveable; but the other bones are carried along with the Os Scaphoides.

885. The articulation of the Os Scaphoides and Cuboides with the three Oſſa Cuneiformia; that of the four laſt mentioned bones, with thoſe of the metatarſus; and that of the metatarſal bones with each other, allow of an obſcure motion, by which we can bend or contract the foot according to its length, and a little according to its breadth likewiſe.

886. All theſe motions of the bones of the tarſus and metatarſus are pretty ſenſible in children; and the loſs of them is often owing to the manner of wearing ſhoes, which loſs is moſt frequent in the ſmall bones of the tarſus and thoſe of the metatarſus. Womens high-heeled ſhoes change entirely the natural ſtate of theſe bones, cauſing in them the ſame ſort of diſorder that we obſerve in the vertebræ of crooked perſons. Thoſe who do not wear ſtrait ſhoes, may preſerve theſe motions to a very advanced age.

887. The articulation of the firſt phalanges of the toes, with thoſe of the metatarſus, is ſpheroidal or orbicular, and allows motion in different directions. The articulation of the phalanges with each other is by ginglymus. In the natural ſtate theſe motions are very free and eaſy, and they are impaired chiefly by the bad manner of wearing ſhoes, and it is for the ſame reaſon that the phalanges of the little toe often grow together.

888. The articulation of the ſeſamoide bones is a kind of ginglymus, but the explication thereof belongs to the hiſtory of the muſcles.

SECT.

SECT. II.

A deſcription of the Freſh Bones.

1. IT is not enough to have an exact knowledge of the ſkeleton, or of the common oſteology; we ought likewiſe to be acquainted with the natural ſtate of the bones when freſh. *Introduction.*

2. The famous Riolan uſed to demonſtrate theſe two kinds of oſteology ſeparately, beginning his courſes of anatomy by the ſkeleton, and concluding them by the natural bony fabric of the body. This laſt he termed *oſteologia nova*, and he has given us an idea of it in a particular treatiſe placed at the end of his Enchiridion Anatomicum. His words are theſe. " There are," he ſays, " two kinds of oſteology; " one of which is to be learned from bones dried and pre- " pared by boiling, *&c.* the other from the bones of a dead " ſubject, as they are naturally connected with each other. " Both theſe methods are very neceſſary for the practice of " phyſic, and for the exact knowledge of the human body.

3. " For, by examining dry bones, we can only learn " their exterior form, their ſituation, and the connection " which they may have with one another. But when we " conſider them as joined together in a dead body, we are " in a condition to obſerve many other things about them " uſeful in phyſick, becauſe their connections with one ano- " ther by cartilages and ligaments, and by the diverſity of " articulations, are ſometimes very different in dry bones " from what we find them when the bones are moiſt and " freſh. There are, for inſtance, in dry bones, certain ca- " vities which appear to be cotyloide, becauſe they are di- " veſted of their cartilages; but in freſh bones they are " found to be glenoide, their cavities being filled by carti- " lages. On the other hand, ſome cavities appear to be " glenoide in the ſkeleton, which are cotyloide in the body, " their cavities being augmented by cartilaginous ſupercilia.

4. " The exterior form and qualities of bones are much " better demonſtrated from freſh ſubjects than from pre- " pared bones, becauſe they loſe a great many things in

“ boiling, ſuch as the cartilaginous borders, the perioſteum, “ the mucilaginous ſubſtance found between them, and the “ marrow contained in their cavities; all which may be “ ſhown in a freſh body, but cannot be ſhown in a ſkeleton.

5. “ It is therefore neceſſary, for the practice of phyſic, “ and eſpecially for the cure of fractured or luxated bones, “ to examine attentively how they are framed, and joined “ together in the body. I would not, however, be thought “ to diſapprove the cuſtom of preſerving dry bones, and of “ teaching the common oſteology. We ought always to “ begin by this, and afterwards ſhew the natural diſpoſition “ of the bones, in the body; in the manner that I have “ done in my courſes.” Theſe are the expreſs words of the illuſtrious Riolan, which I could not help tranſcribing.

6. This method of making a particular, regular, and complete demonſtration of all the bones, newly cleaned from the muſcles and other parts that ſurround them, ſeems to have been wholly neglected ever ſince Riolan's time, till I publicly reſtored it; but inſtead of ending my courſes by the freſh bones, I always demonſtrate them immediately after the ſkeleton, becauſe I look upon this as one of the principal foundations of anatomy; and that it ought naturally to follow the common oſteology, as being a neceſſary introduction to the knowledge of the muſcles.

7. In this oſteology I ſhall obſerve nearly the ſame order as in the former, beginning by what relates to the freſh bones in general, and from thence going on to the particular hiſtory of each bone.

8. The general doctrine of freſh bones takes in their external conformation, internal ſtructure, connection, and uſes.

9. In the particular deſcription I ſhall follow the common diviſion of the ſkeleton; but I chuſe, for reaſons which ſhall be given hereafter, to begin by the extremities, and from thence to proceed to the trunk and the head.

10. I ſhall repeat as little as is poſſible, of what I have ſaid in the deſcription of the ſkeleton; but confine myſelf to thoſe things only in which the differences between dry and freſh bones preciſely conſiſt.

ART. I.

The external conformation of freſh bones.

11. BY the external conformation of freſh bones, I underſtand, as in the common oſteology, all that is viſible without breaking them, ſuch as their ſize, figure, outward parts, and colour.

12. The difference between freſh and dry bones is chiefly owing to the parts that are peculiar to them, and to their natural colour. I ſay, chiefly, becauſe merely by drying, both their ſize and figure may be altered; but theſe alterations are more remarkable in the cartilages than in the bones.

13. Of the external parts of freſh bones, ſome are common to them with dry bones, ſuch as the regions, eminences, cavities, and inequalities; others are peculiar to them, as being either for the moſt part wanting in dry bones; or, if they remain, their natural ſtate being changed.

14. The external parts peculiar to freſh bones are principally the cartilages, ligaments, membranes, and mucilaginous glands. On account of all theſe parts, as well as of the colour, the external conformation of the bones of a freſh ſubject differs from that of a ſkeleton, even in the other parts which are common to both.

15. I ſhall here give a general idea of each of theſe parts, referring what relates to the colour, to the deſcription of the internal ſtructure.

§ 1. *Cartilages of freſh bones.*

16. A cartilage is a whitiſh or pearl-coloured ſubſtance, which covers the extremities of bones joined together by moveable articulations, increaſes the volume of ſome of them after the manner of epiphyſes, unites others very cloſely together, and has no immediate adheſion or connection with others.

17. The ſubſtance of cartilages is more tender and leſs brittle than that of bones; but with age they ſometimes grow ſo hard as to become perfectly bony. They are pliable

and elaſtic, and ſo capable of reſtoring themſelves after having been compreſſed or bent to a certain degree; but when bent beyond that degree, they break.

18. All that I have here ſaid about cartilages, is comprehended in the ſhort definition which Carolus Stephanus has given of them in his anatomy. "A cartilage," he ſays, "is "a part of the body, which truly deſerves the name of ſim-"ple or ſimilar. It is harder than all the other parts, but "ſofter than the bones, white, ſmooth, poliſhed, and pliable "or flexible. The coheſion of its parts is different in different "cartilages; and no ſenſible cavity, cell, or pore, appears "in any part of its ſubſtance, except very ſmall paſſages for "the blood-veſſels," *&c.*

19. I here ſpeak only of cartilages that belong to the bones. Thoſe which have no relation to them, are deſcribed in other parts of this anatomical expoſition. The cartilages which belong to our preſent ſubject, differ from each other, in ſize, figure, ſituation, and uſe; and may all be ranked under two general heads; thoſe which are cloſely united to bones, and thoſe which are not immediately connected with them.

20. The cartilages united to bones are of four kinds, already hinted.

21. Some cover both ſides of the moveable articulations, and are very ſmooth and ſlippery.

22. Some unite the bones to each other, either ſo firmly as to allow no ſenſible motion, as in the ſymphyſis of the Oſſa Pubis, and ſtill more in that by which the epiphyſes are joined to the bones; or in ſuch a manner as to allow of different motions, as in thoſe by which the bodies of the vertebræ are connected. The firſt grow eaſily hard, the others appear in ſome meaſure viſcid, and retain their flexibility.

23. Some increaſe the ſize and extent of bones. Of theſe, again, ſome are articulated with other bones, as the cartilaginous portions of almoſt all the true ribs, or with other cartilages, as the ſeptum narium; others ſerve only for borders, as thoſe of the baſis of the ſcapula, and of the criſta of the Os Ilium, the ſupercilia of cavities, and thoſe of the ſpinal and tranſverſe proceſſes of the vertebræ.

24. Some, in fine, have a ſingular form, as thoſe of the

ears, and moſt of thoſe of the noſe; in which laſt, their elaſticity appears moſt ſenſibly.

25. The cartilages belonging to the ſecond general claſs, or thoſe not immediately joined to bones, are, for the moſt part, placed in the moveable joints; and may likewiſe be ſubdivided into ſeveral kinds.

26. Some lie altogether looſe, being joined neither to the articulated bones, nor to the cartilages which cover them, but ſlide freely between them in different directions; as thoſe which are placed in the articulation of the tibia with the Os Femoris, in that of the lower jaw with the Oſſa Temporum; and in that of the clavicle with the ſternum. Thoſe between the clavicle and acromium, and between the firſt and ſecond vertebræ of the neck, are of the ſame kind.

27. Some are partly joined to other cartilages, and partly ſlide between the cartilaginous extremities of the articulated bones, as the cartilage at the lower extremity of the radius.

28. We might likewiſe reckon among the cartilages, though more improperly, ſeveral of the ſmall ſeſamoide bones which remain long cartilaginous, and alſo the cartilaginous portions of tendons, which do the ſame office with ſeſamoide bones.

§ 2. *The ligaments of freſh bones.*

29. A ligament is a white, fibrous, cloſe, compact ſubſtance, more flexible than a cartilage, not eaſily ruptured or torn, and which does not yield, or at leaſt but very little, when pulled.

30. It is made up of very ſmall and very ſtrong fibres, which, by their different texture and diſpoſition, form narrow cords, broad bands, or thin webs; and theſe ſerve to bind, contain, limit, and defend the other parts both hard and ſoft.

31. I am not here to ſpeak of the ligaments peculiar to the ſoft parts, nor of thoſe which are common to the ſoft and hard parts; but confine myſelf wholly to thoſe which belong to bones or cartilages alone. Of theſe we may eſtabliſh two general claſſes: the firſt, containing thoſe ligaments which are of uſe only to the bones in which they are inſerted; the other, containing thoſe which ſerve for other parts beſides

the bones in which they are fixed, and principally for the muſcles. If we have regard to the bones only, theſe laſt are improperly termed *ligaments*, as not doing the office of ſuch, and conſequently reſembling the true ligaments only in texture.

32. Of thoſe ligaments which are fixed in bones or cartilages alone, and are not employed about the other parts, ſome belong wholly to the articulations or moveable bones, and others have nothing to do with the articulations.

33. The ligaments which belong particularly to the moveable articulations, and may therefore be called *articular ligaments*, are of ſeveral kinds.

34. Some are deſigned only to fix and ſtrengthen the joints, and to ſecure the bones in their different motions, from parting from each other, as it happens in luxations. Theſe ligaments are like ropes more or leſs flat, or like bands, ſometimes narrow, and ſometimes of a conſiderable breadth; and though ſome of them are thin, they are all very ſtrong and yield but little. The ligaments of the articulations by ginglymus, and thoſe that tie the bodies of the vertebræ together, are of this kind.

35. Some contain a very fluid mucilaginous liquor commonly called *Synovia*, which continually moiſtens the articulations. Theſe are not ſo properly ligaments as ligamentary webs, bound immediately round the articulations, and fixed to the extremities of the articulated bones, and thus forming capſulæ or bags to contain that liquor, and hinder it from running out.

36. Theſe may very well be named *capſular ligaments*. They lie within the former ſort, being cloſely united to their internal ſurface, and are to be met with in all the moveable joints, as in that of the ulna with the Os Humeri, thoſe of the bones of the carpus with each other, *&c.* But they are more like membranes than ligaments properly ſo called.

37. Some perform both the former offices, that of a band to keep the bones together, and of a capſula to hold the mucilage. Theſe ſurround the orbicular articulations, as that of the Os Humeri with the ſcapula, of the Os Femoris with the Os Innominatum, *&c.*

38. All the parts of theſe ligaments are not of equal thickneſs, ſo that they appear to be made up of two kinds of li-

gaments inſeparably united or glued together; one capſular which ſurrounds the whole articulation, and ſeveral true ligaments extended at different diſtances over the other, and cloſely united to it. The name of orbicular ligaments is not general enough, becauſe it does not agree to thoſe of the bones of the tarſus, carpus, &c.

39. I do not think it proper to rank among theſe, the membranous vagina belonging to the channel or groove in the upper part of the Os Humeri, which ſhall be afterwards deſcribed.

40. Some are hid by the joints themſelves and by the capſular ligaments, as that belonging to the head of the Os Femoris, called improperly *ligamentum teres*, and the *crucial ligaments* of the tibia.

41. The ligaments which ſerve to connect cartilages with bones, might be reckoned another ſpecies of articular ligaments; and of theſe ſome are proper, as thoſe belonging to the ſemilunar cartilages of the knee, to the cartilaginous trochlea of the orbit, &c. Others are common, as all thoſe to which the inter-articular cartilages are faſtened by their circumferences.

42. The other ligaments of the firſt claſs, or thoſe fixed to bones without any relation to the articulations, are of two kinds.

43. Some of them are looſe, and ſerve only to ſet bounds to the motions of bones; ſuch as thoſe that tye the clavicles to the coracoide apophyſes; thoſe that go from one clavicle to the other, and thoſe between the ſpinal apophyſes of the vertebræ.

44. Some of them are tight, and ſtretched either between the parts of the ſame bone, as the ligaments between the acromium and coracoide apophyſis; or between ſeveral bones united together without motion, as thoſe that are fixed by one extremity to the Os Sacrum, and by the other to the Os Iſchium.

45. The ligaments of the ſecond general claſs, or thoſe which being fixed to bones or cartilages are likewiſe of uſe to other parts, are of two kinds. Some of them are fixed to bones or cartilages only, and ſome are likewiſe fixed to other parts, or other parts are fixed to them.

46. Thoſe of the firſt kind ſerve chiefly to incloſe, check,

limit,

limit, and ſtrengthen the muſcles and tendons, and ſometimes to change their directions.

47. The annular ligaments are of this kind, and they anciently had their name, not ſo much from their figure as from their uſe, which is much the ſame with that of the rings through which the reins of horſes paſs; for it is after the ſame manner that theſe ligaments bridle the tendons of many muſcles, and thus hinder them from ſtarting from their places in violent motions, and, in ſome circumſtances, change their directions.

48. The annular ligaments are either particular and ſimple, or common, and made up of ſeveral ſingle ones, as we ſhall ſee in thoſe of the carpus, thumb, *&c.* Some of them are like vaginæ or ſheaths, as thoſe on the internal or flat ſide of the firſt and ſecond phalanges of the fingers.

49. Some of them are only ſemiannular, as that of the ſuperciliary notch of the orbit, when there is a ligament there, and that of the notch in the ſuperior coſta of the ſcapula.

50. To theſe might be referred the ligaments between the acromium and carocoide apophyſis of the ſcapula, and between the Os Sacrum and Os Iſchium, which have been already mentioned in the firſt claſs.

51. Thoſe of the other kind which come under this ſecond claſs, comprehend the ligaments fixed to other parts as well as to bones; and theſe again are of two ſorts.

52. Some of them are fixed to one or more bones with different degrees of tenſion, and ſerve on each ſide for the inſertion of muſcles, ſupplying in that reſpect the place of bones.

53. Of this kind are the interoſſeous ligaments of the forearm and leg, the abturator ligament; the ligament extended on each ſide of the Os Humeri, from the neck to the condyles, the poſterior and lateral ligaments of the neck, and the ligamentary membranes of the poſterior foramina of the Os Sacrum.

54. To theſe may be added the ligaments commonly termed *aponeuroſes*; ſuch as thoſe of the temples, ſcapula, os humeri, ulna, palm of the hand, thigh, leg, ſole of the foot, *&c.* All theſe ſhall be deſcribed hereafter, and they may in general be termed *aponeurotic ligaments*, *ligamentary aponeuroſes*, *ligamentary ſepta*, *ligamentary vaginæ*, &c. But they ought

to be carefully diſtinguiſhed from the aponeuroſes of the muſcles and tendons, which ſhall be mentioned in their proper places. The ligamentum ſuſpenſorium of the muſculus ſtyloglоſſus belongs to this place.

55. Other differences of ligaments may be deduced from their conſiſtence, ſolidity, thickneſs, ſituation, and figure, as we ſhall ſee hereafter.

56. Some ligaments are almoſt cartilaginous, as thoſe which ſurround the head of the radius, and the ſmall head of the ulna, a portion of the orbicular ligament of the head of the Os Femoris, and the annular vaginæ of the fingers.

57. Some of them have a particular elaſticity, by which they are capable of being drawn out by a ſufficient force, and of contracting again when left to themſelves. This elaſticity differs from that of cartilages, which laſt is hardly perceivable, but by compreſſing or bending them to a certain degree. It differs likewiſe from that of the other ligaments, in that it is not only very conſiderable in living bodies, but remains ſuch after death.

58. Of this kind are the ſupercilium of the cotyloide cavity, the ligaments which tie the Os Hyoides to the ſtyloide apophyſes, the poſterior cervical ligament; the ligaments which connect the ſharp edges of the ſpinal proceſſes of the vertebræ to one another, and thoſe ſeated at the baſis of theſe apophyſes next the great canal of the vertebræ, eſpecially in thoſe of the loins.

§ 3. *The external membranes of freſh bones.*

59. The freſh bones of the human body in their natural ſtate are for the moſt part covered exteriorly by a membrane, called by the general name of *perioſteum*, which is extended over the cartilages and ligaments, as well as over the bones; but where it covers the cartilages, it is termed *perichondrium*, and where it covers the ligaments *perideſmium*. Theſe terms are borrowed from the Greek, but I ſhall not ſpend time in clearing up their original ſignifications.

60. The perioſteum in general is a fine ſtrong membrane, or membranous expanſion, not equally thick in all its parts, more or leſs tranſparent, of a very cloſe texture, not eaſily yielding, extremely ſenſible, and compoſed of ſeveral parti-

cular planes of fibres, differently diſpoſed, and mixed with a great number of ſmall veſſels and nervous filaments.

61. This membrane does not immediately ſurround thoſe portions of bones which are covered by cartilages, nor thoſe in which ligaments and tendons are inſerted. Neither does it cover thoſe portions of cartilages which are expoſed to frictions, as in the moveable articulations, channels, *&c.* Laſtly, it does not cover thoſe portions of the teeth which lie out of the ſockets and gums.

62. The innermoſt plane of the fibrous texture of the perioſteum, or that which immediately adheres to the ſurface of the bones, is fixed thereto by an infinite number of ſmall fibrous extremities brought from all the planes, and which enter the pores of the bones. Theſe extremities are accompanied by capillary veſſels and nervous filaments, which, having run for ſome ſpace between the different planes of the perioſteum, perforate the innermoſt, at the orifices of the pores of the bones.

63. The perioſteum is of different thickneſſes; but this difference does not appear near ſo much on the outer ſurface as on the inner, which is marked in many places with impreſſions owing to the ſulci, depreſſions, lines, and inequalities on the ſurface of the bones.

64. Some anatomiſts have been of opinion, that this membrane was not only united, but cloſely braced round the bones, and that therefore it might ſet bounds to their growth. It is probable they had only examined a few bones in this view; for had they conſidered thoſe which have concave ſurfaces, depreſſions, and inequalities, they would have found only a ſimple adheſion of the perioſteum without any tenſion. In places where it is only fixed to the bones by the filaments of its innermoſt plane, the perioſteum is eaſily pulled from the bones; but this ſeparation is more difficult where the fibres of the other planes likewiſe penetrate the bone, eſpecially when theſe planes are numerous; and likewiſe where the inſertions of tendons or ligaments mingle with theſe fibres.

65. The perioſteum in general ſerves to ſupport that admirable texture of an infinity of capillary veſſels, by which the bones and all the parts belonging to them are nouriſhed. It likewſe ſupports a great number of nervous filaments, by which ſenſation is communicated not only to this and to the

internal membrane of the bones, but even in ſome degree to ſome portions of the bones themſelves. Other uſes of the perioſteum ſhall be explained hereafter.

§ 4. *The mucilaginous glands of freſh bones.*

66. In all the moveable articulations, eſpecially of thoſe perſons who end their lives by ſudden or violent deaths, we find a viſcid liquor, in ſome meaſure reſembling a liquid mucilage, or the white of an egg well beat, which is commonly called *ſynovia*, a name given at firſt to a diſeaſe.

67. This liquor is contained, together with the articulations, in the ligamentary capſulæ, which hinder it from running out. It is furniſhed chiefly by ſmall bundles of glands more or leſs flat, contained in the ſame capſulæ, and known by the name of *mucilaginous glands*, theſe being the organs through which this mucilage is conveyed from the blood. It may likewiſe partly tranſude through the pores of the internal ſurface of the capſular ligaments, and partly be made up of an unctuous matter ſqueezed from the fatty ſubſtances lying near the glands, by the motion and friction of the articulated bones.

68. Theſe glands are more or leſs of a red colour, and of a very ſingulur ſtructure, reſembling ſmall floating fringes, of different thickneſſes, made up of folliculous or veſicular grains, and furniſhed with a great number of veſſels running in very different directions. In ſome places they appear like diſtinct grains immoveably fixed. They are proportioned to the bones and joints, and lodged ſo as to be ſecured from violent frictions, chiefly near the edges of the capſulæ, or in particular cavities contrived on purpoſe to receive them.

69. The liquor continually furniſhed by theſe glands, mixed with that which ſweats through the pores of the capſulæ, and perhaps that which comes from the fatty moleculæ, is diffuſed between the articulated bones; and its uſe is, to facilitate their motions, to prevent them from bruiſing each other, and to keep their cartilages from drying or wearing out.

70. In the particular deſcription, we ſhall explain the differences of mucilaginous glands, with reſpect to their conformation, ſize, number, and ſituation.

ART. II.

The internal ſtructure of freſh bones.

71. IN order to become acquainted with the internal ſtructure of freſh bones, their ſubſtance, internal cavities, marrow, membrana medullaris, and veſſels, muſt be examined. The three laſt belong to this treatiſe; the two firſt have been already deſcribed in the treatiſe of dry bones, which it would be very proper for beginners to reviſe, that they may comprehend as they ought what is here to be ſaid.

§ 1. *The marrow or medullary membrane of freſh bones.*

72. The greateſt part of the bones contain in their large cavities or cells an unctuous fat ſubſtance, of a ſolid conſiſtence in ſome, and ſoft in others. It is called by the general name of *marrow*, eſpecially that which lies in the large cavities of the long bones. That which is diſperſed in the ſmall cellulous cavities, is likewiſe called *the medullary juice.*

73. The marrow of the great hollow bones is a maſs, compoſed of an infinity of fine veſicles or membranous cells, joined together, and communicating with each other, furniſhed with blood-veſſels and nerves, and filled with a fine ſweet oily matter.

74. All theſe cells or membranous veſicles are ſurrounded by a very fine membrane, which, like an internal perioſteum, ſticks cloſe to the inner ſurface of the bone, by means of an infinite number of capillary veſſels, and of ſeveral other kinds of very ſmall filaments. The reticular ſubſtance of the bones runs through this medullary maſs, and as it were interlards it, and by this means ſuſtains it in the middle of the great cavities.

75. The marrow of the cellulous or cavernous ſubſtance of bones is divided by ſmall bony ſepta or plates, and by the filaments of the reticular ſubſtance of bones, into a vaſt number of veſicles or membranous cells, which line the bony cells, and communicate with each other. This cellular marrow

row in the cavernous texture of bones differs from that in the great cavities, both in colour and conſiſtence. It is liquid, and almoſt quite of a red colour; whereas the other is much more ſolid, and is often of a red colour only on its ſurface.

76. This difference is owing to the blood-veſſels which run through each membranous cell, whereas the marrow in the great cavities ſeems to be furniſhed with them in the common membrane only. Many of theſe medullary cells are likewiſe divided by the bony filaments of the cavernous ſubſtance, and theſe ſmall filaments, as well as thoſe of the reticular texture, are covered by portions of the medullary membrane, as by a perioſteum.

77. The medullary membranes may be ſeparated from the liquor which they contain, by ſteeping the whole maſs in very hot water, and afterwards compreſſing it by gentle degrees. But it is to both theſe ſubſtances taken together that anatomiſts give the name of *marrow*, not to either of them taken ſingly. The medullary membrane is very ſenſible, but not the juice; which is neceſſary to be obſerved to underſtand what is meant by the ſenſibility of the marrow. It is true, however, that, in the materia medica, this name is given to the oily ſubſtance alone.

78. The marrow by its liquid and unctuous part renders the bones in ſome meaſure pliable, and leſs brittle, by continually running through the ſubſtance of them in ſmall degrees. This continues to old age, and then the bones being deprived of the marrow, become very brittle.

§ 2. *The veſſels of freſh bones.*

79. All the parts of freſh bones have blood-veſſels, which may be reduced to three claſſes. Some go to the external parts of bones, to the ligaments, cartilages, mucilaginous glands, and perioſteum. Others penetrate the ſubſtance of the bone, and the third kind goes all the way to the internal cavities, and is diſtributed to the marrow.

80. The veſſels of the firſt claſs, that is, thoſe ſpread on the external parts of bones, are ramifications of thoſe which go to the neighbouring muſcles, and other parts which lie near the bones. The greateſt number of them go to the perioſteum,

rioſteum, and run in between its different planes, being divided into an infinite number of capillary ramifications, diſpoſed in a reticular manner by their frequent communications. I ſhall not here take upon me to determine whether this membrane has any particular elaſtic force by which it can increaſe that of the blood-veſſels.

81. The veſſels of the ſecond claſs, or thoſe of the ſubſtance of bones, are productions or continuations of thoſe of the perioſteum, which enter the pores of the bones like very fine filaments, and run longitudinally between the bony fibres. The exiſtence of theſe ſmall veſſels becomes very certain from fractures, eſpecially in young people.

82. The arteries and veins do not ſeem here to accompany each other as in the other parts of the body, but to run in oppoſite directions till they meet. This conjecture is founded on the different obliquity of certain holes. It muſt not however be imagined that all the arteries enter at one end of the long bones, and that the veins go out at the other; the reunion of fractured bones is ſufficient to deſtroy this opinion.

83. The veſſels go to the inner ſubſtance of the bones, not only through the external pores, but alſo through thoſe of all the inner cavities, both great and ſmall, being detached from the medullary membrane in the ſame manner, as from the perioſteum.

84. The veſſels of the third claſs come likewiſe from the perioſteum. They appear to be deſtined chiefly for the marrow and medullary juice, and are ſpread in great numbers over the membranes of each. They enter the cavities of the hollow bones through the oblique ducts in their ſolid ſubſtance, and into the cells by the other ſmall openings. They ſpread themſelves in all directions, not only on the membranes of the marrow and medullary juice, but likewiſe through the ſubſtance of the bones in their paſſage to the inner cavities.

85. The arteries and veins of this claſs often accompany each other as they paſs through the bones, and ſometimes each paſſes through a ſeparate duct.

86. The veſſels of the firſt claſs chiefly no nouriſh the external parts of the bones, and to furniſh the mucilaginous glands with the liquor ſecreted by them. Thoſe of the ſe-

cond claſs furniſh the nutritious juice of the inner ſubſtance of the bones. The uſes of thoſe of the third claſs have been already mentioned.

§ 3. *The colour of freſh bones.*

87. The natural colour of the freſh bones of an adult human body is whitiſh, with a ſmall mixture of a pale red. This red colour is more conſiderable in children, but decreaſes by degrees as they grow up, and is quite loſt in old age. It is moſt remarkable in the ſurface of ſpungy bones, and more towards the extremities of the hollow bones, than in the middle; and laſtly, it is more or leſs perceivable in proportion to the different thickneſs of the bony laminæ which cover the cellular ſubſtance.

88. This red colour is owing to the blood-veſſels of the bones, which being in infancy larger and leſs ſurrounded by the bony juices, than in an advanced age, make the colour of the blood to appear in ſome degrees through the ſubſtance of the bones; whereas in old age theſe veſſels being compreſſed by the increaſed and condenſed bony juices, contain but very little blood, and are not at all tranſparent. The particular differences of the red colour, not only in the bones of the ſame ſubject, but alſo in the different parts of the ſame bone, depends on the medullary juice which is much redder than the marrow in the great cavities, and likewiſe partly on the thickneſs of the bony ſubſtance by which that juice is covered.

A R T. III.

The freſh bones in particular.

89. WHAT has been already ſaid about the mucilaginous glands and blood-veſſels of freſh bones in general, may be eaſily applied to the greateſt part of them in particular. But the cartilages and ligaments are different in each bone, and therefore require to be particularly deſcribed. And as theſe parts are more diverſified, largeſt, and more diſtinct in the extremities of the body than in the trunk; I

think

think it proper to begin by theſe, that they may afterwards ſerve for examples of what is to be ſaid about the reſt.

90. Moreover, as it is only in this oſteology that a true idea can be given of the articulations in their natural ſtate, I ſhall be obliged to begin by the Oſſa Innominata, becauſe of the acetabulum with which the Os Femoris is connected, and becauſe of ſeveral other particulars neceſſary to be known in order to comprehend the mechaniſm of that articulation.

91. Though the Oſſa Innominata belong to the trunk in the ordinary diviſion of the ſkeleton, they may however be conſidered with reſpect to the lower extremities, much in the ſame manner as the ſcapula, with reſpect to the upper extremities. For this reaſon likewiſe I muſt ſay ſomething of the Os Sacrum to which theſe bones are joined, and likewiſe of the laſt vertebra of the loins.

92. This particular oſteology is attended with one difficulty which does not fall in our way in the deſcription of the ſkeleton. We make a complete deſcription of each dry bone, which we cannot do of each freſh bone, becauſe of the connection it has with the neighbouring bones, ſome parts of which muſt conſequently be mentioned, eſpecially thoſe in which ligaments are inſerted.

93. To remove this difficuly, without breaking in upon that order, by obſerving which theſe deſcriptions will be eaſy and intelligible, I ſhall examine particularly the ligaments of each bone in the following manner: I ſhall firſt give the complete hiſtory of the ligaments by which each bone is connected to thoſe immediately above it, and then barely mention thoſe that tie it to thoſe below.

94. I ſhall not explain in what manner or for what purpoſes the bone which I have deſcribed, is joined to that which I am to deſcribe next in order, till the deſcription of this laſt is likewiſe finiſhed. Thus, for inſtance, I ſhall not give the hiſtory of the connection of the Os Innominatum with the Os Femoris, till I have explained all the parts of the thigh-bone concerned in that articulation; nor the hiſtory of the connection of the Os Femoris with the tibia, till the latter has been deſcribed; and ſo of the reſt.

95. This oſteology preſuppoſes the exact knowledge of the foregoing, that is, of all the particulars relating to the ſkeleton;

leton, of which I ſhall here mention only as much as is neceſſary to enable us to apply to the ſkeleton what has been already ſaid in general about freſh bones.

§ 1. *The freſh bones of the lower extremities.*

Cartilages of the Oſſa Innominata.

96. The cartilages of the Oſſa Innominata are not ſo numerous, as one might imagine on examining the ſkeleton only. We are apt to think we ſee the dried remains of cartilages on the criſta of the Os Ilium, on the tuberoſity of the Os Iſchium, and on the grooves and notches which give paſſage to the tendons of muſcles. But none of theſe incruſtations are true cartilages, being for the moſt part tendinous, aponeurotic, or ligamentary, which being dried, look more like cartilages than the true cartilages themſelves.

97. The cruſt which covers the criſta of the Os Ilium is chiefly tendinous, and a ſmall part of it aponeurotic in adult bodies, but in children and very aged perſons it appears cartilaginous. In children, the parts which are not completely oſſified, are eaſily taken for true cartilages; and in old age the tendons are often hardened to ſo great a degree, as to have the very ſame appearance. The ſubſtance which covers the tuberoſity of the Iſchium is almoſt entirely tendinous, and that which lines the grooves and notches of the tendons is chiefly ligamentary.

98. The true cartilages of the Oſſa Innominata in adult ſubjects, are five in number, three common, and two proper.

99. The firſt and principal common cartilage is that which makes the ſymphyſis of the Oſſa Pubis. It reaches from the interval between the ſpines of theſe two bones, all the way to the angle formed by the two rami, where they begin to ſeparate. It is ſomething thicker or broader at its upper part, than for a conſiderable ſpace lower down, but the inferior part is by much the broadeſt. It fills the angle already mentioned, and forms a kind of arch, which is more conſiderable in women than in men.

100. The two other common cartilages join the Oſſa Ilium to the Os Sacrum, but are thinner than that of the Oſſa Pubis.

101. The proper cartilages are thoſe that line the cotyloide cavities. Concerning theſe we have already obſerved in the deſcription of the ſkeleton, that in the edge of each, there is a notch or opening between the anterior and inferior parts; and that in the cavity itſelf, there is a broad, unequal ſhallow depreſſion, reaching from the notch, beyond the middle of the cavity. All the reſt of the ſurface of the acetabulum is covered with a very white, ſhining, ſmooth cartilage, which terminates preciſely at the edge of the cavity.

102. The circumference of the acetabulum has, beſides, a border of a particular kind, the ſubſtance of which is neither wholly cartilaginous nor wholly ligamentary; but I chuſe to place it among the ligaments.

Ligaments of the Oſſa Innominata.

103. The ligaments of the Oſſa Innominata are of two kinds, common and proper. The common ligaments are thoſe which go between theſe and the neighbouring bones, of which there is a conſiderable number, *viz.*

104. One ſuperior ligament inſerted by one end in the internal labium of the poſterior part of the criſta of the Os Ilium, about an inch above the angle of that criſta. It is about an inch in breadth, and is faſtened by its other extremity in the whole inferior edge of the tranſverſe apophyſis of the laſt vertebra of the loins.

105. One inferior and anterior, fixed by one end in the inner ſide of the angle of the criſta of the Os Ilium, and by the other in the ſuperior and anterior part of the firſt falſe tranſverſe apophyſis of the Os Sacrum. In this ligament there are tranſverſe openings which make it appear more or leſs complex.

106. Several inferior and poſterior, fixed by one end along the internal labium of the tuberoſity of the criſta of the Os Ilium, and by the other in the firſt three falſe tranſverſe apophyſes, and from thence extending laterally over the marks of the falſe oblique apophyſes of the Os Sacrum.

107. To theſe muſt be added the ligaments by which the Os Femoris is joined to the Os Innominatum, which ſhall be deſcribed among the other ligaments of the thigh.

108. The principal proper ligaments are four in number,

two called *ſacro-ſciatic*, one broad and external, the other ſmall and internal, one obturator and one inguinal.

109. The broad ſacro-ſciatic or internal ſciatic ligament is ſlightly faſtened to the inſide of the tuberoſity of the criſta of the Os Ilium, covers exteriorly the two poſterior ſpines of that bone, and continues to be inſerted along the anterior and exterior edges of the falſe tranſverſe apophyſes of the Os Sacrum.

110. From thence this ligament diminiſhing in breadth, deſcends obliquely towards the tuberoſity of the Iſchium, and is inſerted immediately below the ſinus which lies between that tuberoſity and the ſciatic ſpine. This inſertion is afterwards continued over the whole internal labium of the inferior portion of the Os Iſchium, and of the ramus of that bone, and the inferior portion of the ramus of the neighbouring Os Pubis.

111. Through all this latter courſe of its inſertion, that is, after its arrival at the tuberoſity of the Iſchium, it produces a kind of ligamentary falx, one edge of which is fixed to the bones, the other lies looſe; and by this ſituation of the falx, it forms, together with the bones, a kind of deep channel or groove.

112. The ſame ſacro-ſciatic or internal ſciatic ligament adheres cloſely to the inſide of the poſterior portion of the former. It is fixed anteriorly to the edge of the inferior part of the fourth falſe tranſverſe apophyſis of the Os Sacrum, and from thence, all the way to the upper part of the Os Coccygis.

113. From this inſertion, it runs up a little obliquely to the ſpine of the Iſchium, in the ſharp point and upper part of which it is fixed. During this courſe, it croſſes the broad ligament, being cloſely united to the inſide thereof, and loſes but very little of its breadth.

114. By theſe two ligaments two diſtinct openings are formed, a large one, with the ſuperior ſciatic ſinus, and a ſmall one with the inferior ſciatic notch.

115. The obturator ligament fills up all the great foramen ovale, except the oblique notch at its upper part. It is faſtened preciſely to the edge of the circumference of that hole, from the anterior part of the oblique notch, all the way to the ſymphyſis between the Os Pubis and the Os Iſchium.

116. From thence to the poſterior part of the inferior notch, it is fixed to the internal labium of the edge of the circumference, forming a kind of ſmall channel with the external labium; and afterwards it is fixed to the common edge of the foramen ovale and cotyloide notch or opening.

117. By this diſpoſition, an opening is left between this ligament and the ſuperior oblique notch; and immediately below this common opening, there are two ſmall perforations in the ligament alone.

118. On the inſide of the upper and anterior part of the Os Pubis, there is a tranſverſe ligament, reſembling the ſhape of a pent-houſe; fixed by its upper part to the Os Pubis, from the oblique notch of the foramen ovale, all the way to the lower part of the ſymphſis, at a ſmall diſtance from the circumference of the laſt mentioned hole.

119. This tranſverſe ligament is about half an inch in breadth in an adult body; and poſteriorly below the ſuperior oblique notch of the foramen ovale, it joins the obturator ligament, by means of a particular fold; and by parting from it afterwards, a kind of deep narrow groove is formed between them, the tranſverſe ligament being at this place ſupported by ligamentary fræna of different ſizes.

120. The inguinal ligament, called from the diſcoverer *ligamentum Fallopii*, is an aponeurotic or ligamentary band, faſtened by one end to the anterior and ſuperior ſpine of the Os Ilium, and by the other, to the ſpine of the Os Pubis. The middle portion of it is very narrow, but it expands conſiderably toward both extremities. It is cloſely joined to the muſcles of the abdomen, and to the aponeurotic faſcia of the thigh. It ſeems to be often wanting, as ſhall be obſerved in the deſcription of theſe muſcles.

121. Beſides theſe ligaments peculiar to each Os Innominatum, there is another ſmall flat and very ſtrong ligament, which runs tranſverſely between the two angles of the cotyloide notch, and may be termed *the proper* or *tranſverſe ligament* thereof.

122. The elaſtic border of the cotyloide cavity may likewiſe be reckoned among the ligaments. It is a ſort of additional piece ſtrongly united to the edge of that cavity, but eaſily yields both ways to any preſſure. It may be ſtretched out by pulling, and recovers and contracts again when that

force is removed. It is of a very ſingular texture, being compoſed of elaſtic fibres, interwoven together through its whole circumference, and which, in ſeveral places, are by degrees inclined toward the bony edge of the cavity. It makes an entire circle, and where it paſſes over the notch, the tranſverſe ligament before mentioned ſerves to ſupport it, as the bony edge of the cavity does through all the reſt of its circumference.

123. Though I have referred the deſcription of the two ligaments by which the Os Femoris is connected to the Os Innominatum to another place, their inſertions in the laſt named bone muſt nevertheleſs be mentioned here. One of theſe ligaments ſurrounds the whole articulation, the other is contained therein. The firſt is called *the orbicular ligament*, the other very improperly *the round ligament*.

124. The orbicular ligament is very ſtrong, and unequally thick. It ſurrounds the whole convex circumference of the ſupercilium of the cotyloide cavity, to which it is ſtrongly fixed for the breadth of near a quarter of an inch, from the ſharp edge outward, and from thence ſeems to ſend off a ligamentary aponeuroſis, which ſhall be explained in the hiſtory of the muſcles.

125. Its inſertion at the ſharp edge of the cotyloide cavity, joins that of the elaſtic border; the reſt of the ligament is diſtinct from the border, and only touches it quite round; and where it paſſes over the notch, it is fixed in the tranſverſe ligament.

126. The ligament which lies in the joint is not round, as its common name would make us believe. It is a flat cord, broad at one end, and narrow at the other, and therefore in ſome meaſure of a triangular ſhape. By its narrow end, it is inſerted at the two angles of the notch of the cotyloide cavity; and by the other in the Os Femoris, in the manner hereafter to be deſcribed. This broad end may be reckoned the baſis of the ligament; and from thence ariſe ſome diſtinct ligamentary filaments, which are inſerted, at different diſtances, in the circumference of the rough impreſſion of the cotyloide cavity.

Membranes, mucilaginous glands, and marrow of the Os Innominatum.

127. There is nothing in the perioſteum of this bone different from what has been ſaid above, except what

relates to the inſertion of ſeveral muſcles; but that cannot be explained till theſe muſcles are deſcribed.

128. The rough unequal depreſſion at the bottom of the cotyloide cavity is filled by a broad flat mucilaginous gland, bordered with a fatty ſubſtance, and covered by a fine membrane, through which a mucilaginous liquor paſſes, to moiſten the joint, and facilitate its motions. This membrane riſes above the gland, and gives a ſort of covering or coat to the ligament contained in the joint. The blood veſſels of this gland paſs between the bottom of the cotyloide notch, and the tranſverſe ligament thereof.

129. As theſe bones have no internal cavity, and their ſubſtance being cellulous or cavernous, they contain no medullary maſs. The ſmall cells of their cavernous ſubſtance contain a medullary juice, which diſtils inceſſantly through the membrane with which they all are lined.

130. The blood-veſſels paſs chiefly through the ſmall holes in both convex and concave ſurfaces of theſe bones, and ramifying upon the bony cells, they end in a great number of ſmall capillary tubes, which make the medullary juice appear red.

Cartilages of the Os Femoris.

131. No part of the Os Femoris is covered with cartilage, except the uniform convexity of its head, and the articular portion of the lower extremity. The trochanters have no true cartilage; what looks like it, being only the remains of tendinous inſertions, as has been already obſerved of the criſta of the Os Ilium. The cartilaginous ſubſtance, which, to a certain age, unites the epiphyſes to the body of the bone, does not belong to this place, becauſe it is only found in the time of youth, and in adults is converted into bone.

132. The cartilaginous matter by which the head of the Os Femoris is cemented, deſerves, however, to be obſerved, becauſe that epiphyſis has been ſeparated by violent falls.

133. The convexity of the head of the Os Femoris all the way to its ſymphyſis with the neck, is covered by a very ſmooth ſhining cartilage. We have already remarked in deſcribing the dry bones, that a little below the middle of this convexity, and ſomething toward the back part, there is a

depreſſion in the ſhape of a creſcent, the cartilage being here interrupted by the inſertion of the internal articular ligament of the head of the Os Femoris.

134. The cartilage which covers the lower extremity of this bone, is exactly fitted to the ſemi-oval convexity of the inferior ſurface of each condyle, and to the pulley formed by their union.

135. In the poſterior part of the lateral tuberoſity of each condyle, there is another kind of cartilaginous ſurface, which was ſpoken to in the hiſtory of the tibia.

Ligaments of the Os Femoris.

136. The Os Femoris is connected by its upper extremity to the Os Innominatum, and by the lower to the bones of the leg, by means of ſeveral ligaments. The ligaments of the upper extremity are two in number, one which ſurrounds the whole articulation thereof with the cotyloide cavity, and one contained in the articulation. The firſt is termed *the orbicular ligament of the head of the Os Femoris*; the other, *the internal ligament.* To theſe we may, though very improperly, add a third, which is of the nature of a capſular ligament, as we ſhall ſee hereafter.

137. The orbicular ligament is the moſt conſiderable, largeſt, and ſtrongeſt of all the articular ligaments of the human body. It is fixed quite round the border of the cotyloide cavity in the manner already ſaid; and from thence largely ſurrounds the whole head and ſuperior portion of the neck of the Os Femoris, and is cloſely inſerted in the lower portion of the neck, that is, between its baſis and middle narrow part.

138. This ligament is made up of ſeveral ſorts of fibres, the chief of which are longitudinal and oblique, and it is much thicker and ſtronger in ſome parts than in others. It is very thick between the anterior inferior ſpine of the Os Ilium all the way to the ſmall anterior tuberoſity, which unites, as it were, the baſis of the great trochanter with the baſis of the neck.

139. It is likewiſe very thick between the ſame ſpine, and the middle part of the oblique rough line obſervable between the tuberoſity and the little trochanter; and here likewiſe it is ſtrengthened by a bundle of fibres connected to the paſ-

ſage of the tendon of the iliac muſcle, and to the inferior portion of the oblique rough line. The diſpoſition of the ligamentary fibres of which theſe two thick portions are compoſed, form a ſort of triangle with the oblique rough line which terminates the baſis of the neck.

140. At the poſterior and upper part of this ligament, there is another thick portion formed by oblique fibres, one end of which is fixed between the inferior edge of the cotyloide cavity, and the paſſage of the tendon of the external obturator muſcle; the other, to the upper part of the ſmall tuberoſity of the great trochanter, already mentioned.

141. The poſterior and lower part of it is thinner and ſhorter than the reſt; but even this is ſtrengthened by a band of pretty ſtrong fibres, which, from the whole criſta of the Os Pubis, runs down obliquely near the foreſide of the cotyloide notch, and is fixed in the upper part of the baſis of the neck of the Os Femoris, immediately above the ſmall anterior tuberoſity of the great trochanter.

142. The other ligament of the head of the Os Femoris, which I call *internal*, reſembles a flat cord, being compoſed of a bundle of fibres cloſely interwoven. One end of it is in a manner divided into two flat bands, inſerted one at each corner of the cotyloide notch in the manner already explained. It might likewiſe be called *the interarticular ligament of the head of the Os Femoris.*

143. From this inſertion, it runs obliquely backward and a little upward between the cotyloide gland, and the cartilaginous convexity of the head of the Os Femoris, and ends in the upper part of the ſmall ſemilunar foſſula, which may be reckoned the pole of that convexity. This inſertion is oblique, a little rounded on the upper part, and flat on the lower, and in ſome ſubjects there is a ſort of depreſſion in the head of the bone for the paſſage of the ligament.

144. The ligaments of the lower extremity of the Os Femoris, by which this bone is connected with thoſe of the leg, are ſix in number, one poſterior, two lateral, two middle or crucial, and one capſular.

145. The crucial ligaments lie within the joint, and are fixed by one end to the back part of the notch or opening which parts the two condyles. They are ſurrounded by the

capſular ligament, but all the reſt lie on the outſide thereof, being cloſely joined to it.

146. Of the two lateral ligaments, one is internal and broad, being fixed to the tuberoſity of the internal condyle; the other is external and narrow, fixed to the tuberoſity of the external condyle.

147. The poſterior ligament is broad and thin, being fixed a little above the convexity of the external condyle, from whence it deſcends obliquely, behind the great notch and internal condyle.

148. The capſular ligament glued, as it were, to the three former, as has been ſaid, is fixed quite round the inferior extremity of the Os Femoris, at a ſmall diſtance above the anterior, lateral, and poſterior parts of the cartilage, and above the poſterior part of the great notch, and from the cartilage and notch, through the ſmall ſpace upward already mentioned, it covers the bone; and afterwards is inverted downward to form the capſula for the mucilaginous liquor of the joint. The reſt of the deſcription of all theſe ligaments muſt be referred to that of the bones of the leg.

Marrow of the Os Femoris.

149. The marrow of the Os Femoris lies in a large maſs in the middle cavity of the bone, and in ſmall diſtinct cluſters in the cells of each extremity. The firſt is penetrated at different diſtances by the bony filaments or ramifications of the reticular texture, and thereby ſuſtained in violent motions and ſhocks, as in leaping, running, &c.

Cartilages of the bones of the leg.

150. The tibia has four or five proper cartilages, and two additional ones.

151. The two proper cartilages which cover the two ſuperior ſurfaces of the head of the tibia, are the thickeſt. They are both gently hollow; but the internal, or that next the other tibia, is more depreſſed in the middle than the other. The back part of the external is inſenſibly depreſſed, and thereby a ſort of convexity is formed. Anteriorly they join each other, poſteriorly they are parted by a ſhallow notch; in the middle, they are ſeparated by the articular tuberoſity of the head of the tibia, which is likewiſe partly covered by them on each ſide.

152. The third proper cartilage covers the ſmall ſurface which lies on the lower part of the external condyle.

153. The fourth covers the lower ſurface of the baſis of the tibia, being continued over the outſide of the inner ancle. There are likewiſe ſuperficial cartilaginous incruſtations on the back part of this baſis behind the inner ancle, and likewiſe on the backſide of the outer ancle, all for the paſſage of tendons.

154. The additional cartilages of the tibia are two in number, called *ſemilunar* from their figure, and *intermediate* or *interarticular* from their ſituation.

155. Each of theſe cartilages is in the ſhape of a creſcent or Roman C. Their convexity or greateſt curvature is very thick, their concavity or ſmalleſt curvature very thin, ſomething like the edge of a ſickle. They lie on the two upper ſurfaces of the head of the tibia; their thickeſt part or convexity anſwering to the edges of the head, and their thin ſharp edges, to the middle of each ſurface, their extremities or cornua being turned toward each other.

156. Each cartilage is broad enough to cover about two thirds of the ſurface of the tibia, on which it lies, leaving one third bare in the middle. Their under ſides are flat; the upper ſides hollow, and together with the middle portions of the ſurfaces of the head of the tibia, form cavities proportionable to the convexity of the condyles of the Os Femoris.

157. The fibula has two cartilages, one lying on the upper extremity of that bone, for its articulation with the ſmall cartilaginous ſurface in the head of the tibia. The other cartilage covers the inſide of the inferior extremity, or of the outer ancle, near the point of which poſteriorly there is a ſuperficial cartilaginous incruſtation for the paſſage of the tendons of the muſculi peronæi. The cartilage at the upper extremity of the fibula ſeems to be thicker than that at the lower extremity.

158. The patella which belongs properly to the tibia and not to the Os Femoris, has a pretty thick cartilage on its poſterior or articular ſide, divided by a ſuperficial longitudinal riſing into two parts proportioned to the two portions of the pulley of the Os Femoris, as has been obſerved in the deſcription of the dry bones.

159. I have already obſerved, that the tibia is connected

with the Os Femoris by ſeveral ligaments, two lateral, one poſterior, two middle, and one capſular, and I have ſhewn in what manner they are fixed in the lower extremity of the Os Femoris. Their inſertions in the bones of the leg are as follow.

Ligaments of the bones of the leg.

160. The innermoſt and broadeſt of the two lateral ligaments is fixed pretty low down, on the inner ſide of the ſuperior part of the tibia, between the beginning of the criſta or anterior angle of that bone, and the internal angle which is turned toward the other tibia. It is likewiſe joined to the edge of the internal ſemilunar or interarticular cartilage.

161. The external lateral ligament, which is narrower and thicker than the former, is fixed partly in the tibia immediately above the fibula, and partly in the upper extremity of the fibula, and is joined likewiſe to the edge of the external ſemilunar cartilage. Both theſe ligaments lie a little behind the middle of the articulation.

162. The poſterior ligament is fixed by ſeveral expanſions in the poſterior part of the head of the tibia.

163. One of the crucial ligaments is fixed by one end to the internal ſuperficial impreſſion in the notch of the Os Femoris, and by the other to the notch in the head of the tibia, behind the cartilaginous tubercle which lies between the two ſuperior ſurfaces. The other crucial ligament is fixed by one end to the external impreſſion in the notch of the Os Femoris, and by the other between the anterior portions of the ſurfaces juſt mentioned, before the cartilaginous tubercle.

164. Theſe two ligaments are compoſed of ſeveral ſeries of fibres. The firſt, which is internal in reſpect of the Os Femoris, and poſterior in reſpect of the tibia, is broader and ſtronger than the other, which is external in reſpect of the Os Femoris, and anterior in reſpect of the tibia.

165. The ſemilunar cartilages have likewiſe particular ligaments, beſides their connections with the lateral ligaments of the tibia. Their cornua do in ſome meaſure degenerate into ſhort ſtrong ligaments, by which they are faſtened to the cartilaginous tubercle between the two ſuperior ſurfaces of the tibia, and likewiſe communicate, by ſome portions, with the crucial ligaments.

166. They have likewiſe a common ligament, which like

an arch runs tranſverſely between the anterior convexity of the one to that of the other.

167. Theſe cartilages therefore have three ſorts of connections. They are faſtened to the tibia by the ligaments of the cornua; to each other by the tranſverſe ligament; and to the Os Femoris by their communications with the crucial ligaments, and by their adheſions to the lateral and capſular ligaments.

168. The patella is faſtened to the tuberoſity or ſpine of the tibia by a broad and very ſtrong ligament which runs down directly from the apex of the patella, and is oftentimes further ſtrengthened by ſome fibres of a conſiderable tendon inſerted in the upper part of that bone.

169. It has likewiſe ſmall lateral ligaments fixed in the lower part of its edge on each ſide, which parting gradually from the great ligament as they run down, are inſerted anteriorly and a little laterally in the edge of the head of the tibia.

170. The capſular ligament of this joint, of which I deſcribed one part in ſpeaking of the lower extremity of the Os Femoris, is fixed round the edge of the head of the tibia, and in the edge of the patella, ſo that the patella itſelf forms a portion of the mucilaginous capſula of the joint of the knee.

171. The crucial ligaments, and thoſe of the ſemilunar cartilages are included within this capſula; but the lateral and poſterior ligaments and thoſe of the patella lie without it, being cloſely joined to its outer ſurface.

172. This capſula is likewiſe joined to a conſiderable portion of the circumference of the ſemilunar cartilages; and it is alſo ſtrengthened at different diſtances, by ſeveral diſtinct ſeries of ligamentary fibres, more or leſs thick. The inſide of it is ſmooth and ſhining, and it is very thin where it is not covered by tendons, as ſhall be obſerved hereafter. It not only contains and ſurrounds the ligaments already named, but likewiſe furniſhes them with a very fine vagina

173. There is likewiſe a very thin ligament fixed by one end to the lower part of the cartilaginous ſide of the patella, and by the other to the anterior part of the great notch between the condyles of the Os Femoris, the uſe of which

ſeems to be to hinder the articular fat from being compreſſed in the motions of the knee.

174. The fibula is joined to the tibia by nine ligaments, four at each end, and one in the middle, called *the interoſſeous ligament.*

175. The ligaments at the upper extremity of the fibula are ſhort, very ſtrong, more or leſs oblique and compound. Two of them are anterior, two poſterior, and they lie on each other; the ſuperior ligaments ſurrounding the articulation more cloſely than the inferior, which leave a ſmall void ſpace, and are weaker than the former. They are all glued to the capſular ligament which runs in between them and the articulation, and they are inſerted round the edges of the cartilaginous ſurfaces in each bone.

176. The ligaments of the lower extremity of the fibula, which runs below the tibia, and forms the outer ancle, are much ſtronger, thicker, more complex, broader, longer, and more oblique than thoſe of the ſuperior extremity; and are diſpoſed much after the ſame manner, that is, two before and two behind.

177. They are fixed to the anterior and poſterior edge of the lateral depreſſion at the inferior extremity of the tibia, and from thence they run down on the lower end of the fibula. The two inferior ligaments are longeſt, and they are fixed anteriorly and poſteriorly at the lower end of the outer ancle. The two ſuperior are fixed more cloſely and nearer each other, but ſtill there is a ſmall ſpace between them filled with fat.

178. As the two bones touch each other only by the upper part of the cartilaginous ſurface of the outer ancle, and the ſmall cartilaginous border in the lower edge of the depreſſion of the tibia, the middle ſpace between them is filled by a ſort of capſular ligament, which lines each ſide of the bones, and is continued down to the true articulation of the external ancle, with the inferior edge of the baſis of the tibia.

179. The middle or interoſſeous ligament of the two bones of the leg, ſo called, becauſe it fills up all the ſpace left between them, being ſtretched from one to the other, is fixed along the poſterior external angle of the tibia, and the neighbouring angle of the fibula.

180. It is made up chiefly of two planes of very oblique ligamentary fibres, which croſs each other, and at different intervals, ſeem to be multiplied. It is perforated both above and below, and ſometimes in ſeveral places beſides, for the paſſage of the blood-veſſels and nerves.

181. It is not a ligament deſigned to tie theſe bones together, but rather a ligamentary ſeptum for the inſertion of muſcles, in which reſpect it ſupplies the place of bones, and ſeems partly to be a continuation of the perioſteum of the tibia and fibula.

182. At the lower part of each ancle there are commonly three ſtrong ligaments for the connection of the bones of the tarſus with thoſe of the leg, one that runs forward, one that runs backward, and one that runs more or leſs directly downward; all of them being fixed in the places hereafter to be mentioned.

183. There are ſome other ligamentary expanſions belonging to the bones of the leg; but as they do not ſerve ſo much for the connection of the bones, as to ſupport the muſcles, the deſcription of them, as well as of the annular ligaments, will more naturally come in, in the treatiſe of the muſcles.

Marrow and mucilaginous glands of the bones of the leg.

184. The marrow of theſe bones lies in large maſſes in the great cavities, and in diſtinct moleculæ in the ſpungy parts, as has been already obſerved in general.

185. The mucilaginous glands lie in the ſmall ſpaces, depreſſions, and ſuperficial notches near the edges of the cartilages of each joint. They are covered by the capſular ligaments, and more or leſs mixed with a fatty ſubſtance.

186. The glands of the knee, which lie near the edges of the patella, are the moſt conſiderable, being diſpoſed in form of fringes, and ſupported by a great quantity of fatty matter, which makes in ſome meaſure one maſs with them.

187. This common maſs is contained within the capſular ligament, and on the ſide of the joint is covered by a very fine membrane, which likewiſe lines the inner ſurface of the ligament. The glandulous ſubſtance is eaſily diſtinguiſhed from the fat, by the reddiſh colour of the capillary veſſels which ſurround the glands.

188. The ſuperior portion of this maſs is as it were ſuſpended by the ſmall ligament, fixed in the anterior part of

the great common notch of the condyles of the Os Femoris, and which from thence runs to the upper part of the patella, as has been already obſerved in the deſcription of the ligaments.

189. There are other mucilaginous glands both above and below the edges of the ſemilunar cartilages.

190. And likewiſe in the ham, ſome whereof ſerve for the joint, the reſt, for the crucial ligaments. Theſe laſt lie in folds formed by the internal membrane of the capſular ligament, which give particular coverings to the crucial ligaments, and to the other bundles of ligamentary fibres near them.

Cartilages of the bones of the foot.

191. The aſtragalus is covered by three cartilages. The firſt covers the three ſurfaces, which make the convex part and ſides of the pulley; the ſecond, the concave ſurface of its inferior part; and the third, the convex ſurface of its anterior part, being continued over the inferior part, ſo far as to form three other ſmall ſurfaces, one of which is not articular in a ſtrict ſenſe.

192. The firſt of theſe cartilages is for the articulation of this bone with the tibia and fibula; the ſecond, for the Os Calcis; and the third, for the Os Scaphoides. Two of the inferior ſurfaces formed by the continuation of the third cartilage, are for the articulation of this bone with the Os Calcis; the third contributes to the formation of a channel for the paſſage of a tendon.

193. The Os Calcis has four cartilages, of which three are ſuperior, one large and two ſmall for its triple articulation with the aſtragalus; the fourth is anterior, for the Os Cuboides. To theſe muſt be added a ſmall thin cartilage, of a kind of ligamentary ſubſtance under the tubercle on the outſide of this bone.

194. The Oſſa Scaphoides has two cartilages, one poſterior for its articulation with the aſtragalus; and one anterior divided into three parts for the three Oſſa Cuneiformia,

195. The Os Cuboides has two remarkable cartilages, one poſterior for its articulation with the Os Calcis, and one anterior lying in two planes for its articulation with the two laſt metatarſal bones. It has likewiſe a cartilage on the inſide for the Os Cuneiforme which is next to it, and one on the lower

ſide, covering a part of the oblique eminence ſituated there.

196. The three Oſſa Cuneiformia have each of them a poſterior cartilage for their articulation with the Os Scaphoides, and one interior for the three firſt metatarſal bones; they have likewiſe ſmall cartilaginous ſurfaces on their lateral ſides, for their articulations with each other; and beſides, the firſt and third bones are joined thereby to the lateral parts of the baſis of the ſecond metatarſal bone, and the third, to the Os Cuboides.

197. The baſes and heads of the metatarſal bones are covered with cartilages.

198. The phalanges have cartilages in the ſame manner at their baſes and heads, except at the heads or extremities of the laſt.

199. The ſeſamoide bones are covered with cartilages on that ſide by which they ſlide on other bones.

200. We ought to beware of confounding the remains of tendons, ligaments, and aponeuroſes with the true cartilages; as for inſtance, at the poſterior part of the Os Calcis. I gave the ſame caution when I ſpoke of the cartilages in general.

Ligaments of the bones of the foot.

201. The foot being made up of many bones, muſt, beſides thoſe ligaments by which it is tied to the bones of the leg, have ſeveral others to connect not only the three parts of which it is compoſed, but alſo the particular bones belonging to each part.

202. I have already mentioned the inſertions of three ligaments in each ancle, one interior, one middle, and one poſterior, for the articulation of the ancles with the foot.

203. The ligaments of the inner ancle are all fixed in the inſide of the aſtragalus. The moſt anterior is pretty broad, and ſometimes ſeems to be joined in one with the middle ligament. It often conſiſts of ſeveral diſtinct parts like ſo many bands interlarded with fat.

204. The anterior and middle ligaments of the outer ancle, being more or leſs broad, are fixed in the outſide of the aſtragalus; the poſterior, which is the narroweſt and pretty thick, is chiefly fixed in the outſide of the great portion of the Os Calcis.

205. All theſe ligaments lie on the outſide of the capſula, which ſurrounds the articulation of the aſtragalus with the bones of the leg.

206. The ligaments by which the bones of the tarſus are connected with each other, are ſhort, flat, of different breadths, and run from one bone to another in various directions. They are all ſuperficial, except one, by which the aſtragalus is tied to the Os Calcis, and for the moſt part are either ſuperior or inferior, the lateral ligaments being but very few in number.

207 Some of them are partly common to ſeveral bones, and partly belong only to two; that is, the ſuperficial ſtrata of their fibres run over one bone into the following, and ſometimes further; but the ſtrata next the articulation are generally confined to two bones only.

208. The aſtragalus is tied to the other bones of the tarſus, by ſeveral true ligaments, *viz.*

209. To the inſide of the Os Calcis by a ligament which comes from the poſterior internal tuberoſity of the body of the aſtragalus, and is fixed in an equality behind the lateral apophyſis of the Os Calcis.

210. To the inſide of the ſame bone by a ligament which comes from the lateral apophyſis of the Os Calcis, and is fixed in a ſort of cartilaginous production on the inſide of the neck of the aſtragalus.

211. To the outſide of the ſame bone by two ligaments which come from the edge of the oblique inferior depreſſion of the aſtragalus, and afterwards ſeparating a little, are fixed in the outſide of the great apophyſis of the Os Calcis, one forward, which ſeems to ſend off a ſmall portion to the Os Cuboides, the other backward, of different breadths.

212. To the Os Scaphoides ſuperiorly by a ligament which goes from the neck of the aſtragalus to the upper part of the Os Scaphoides, and from thence is extended to the middle Os Cuneiforme.

213. To the ſame bone interiorly by two ligaments, one of which is a continuation of that which goes from the lateral apophyſis of the Os Calcis to the cartilaginous production of the aſtragalus; the other is near the ſame production, being partly covered by the former, and fixed in the tuberoſity of the Os Scaphoides.

214. To the Os Calcis, by a ligament which comes from the oblique inferior depreſſion of the aſtragalus, and is fixed in the oblique ſuperior depreſſion of the Os Calcis.

215. If to theſe principal ligaments of the aſtragalus, we

add ſeveral others leſs remarkable, and alſo thoſe by which it is tied to the ancles, their number will be very conſiderable.

216. The capſular ligaments go very little further than the edges of the articulations of this bone with the reſt. They adhere very cloſely to the true ligaments, and are covered and hid by them.

217. The Os Calcis is joined to the outer ancle and aſtragalus by the ligaments already deſcribed. It is likewiſe connected to the Os Scaphoides and Os Cuboides by ſeveral ligamentary planes.

218. It is connected to the Os Scaphoides. (1.) By a continuation of the ligament that goes from its lateral or internal apophyſis to the cartilaginous production of the aſtragalus. (2.) By a ligamentary plane which goes from the inferior tuberoſity of its great apophyſis, and is fixed in the inferior part of the circumference of the Os Scaphoides. (3.) By a narrower ligament which goes from the ſuperior and internal part of the ſame apophyſis, and ends in the neareſt part of the circumference of the Os Scaphoides.

219. It is connected to the Os Cuboides. (1.) By a ligament, or rather by ſeveral ligamentary faſciculi which go from the extremity of its oblique ſuperior depreſſion to the contiguous angle of the Os Cuboides. (2.) By one lying between the firſt, and the ſmall external lateral tuberoſity of the Os Calcis, and inſerted in the Os Cuboides near the firſt. (3.) By one which is fixed to the exterior and inferior part of the great apophyſes of the Os Calcis, and to the contiguous part of the Os Cuboides. (4.) By a pretty broad plane which covers the inferior part of the Os Calcis, and which from the anterior tuberoſity of this part, ſpreads over the contiguous inferior part of the Os Cuboides, and ends in the oblique eminence of that bone. (5.) By a broader plane, which having filled the lower part of the lateral concavity of the Os Calcis, is chiefly inſerted in the contiguous angle of the Os Cuboides.

220. The capſular ligaments agree with thoſe of the aſſtragalus.

221. The Os Scaphoides is tied to the aſtragalus and Os Calcis in the manner already ſaid.

222. It is likewiſe joined to the Os Cuboides and the Oſſa Cuneiformia by ſeveral ligaments. On the outſide, or that

next the Os Cuboides, there is one which connects it to the contiguous angle of that bone. On its upper part, two go from its circumference, one to the ſecond, the other to the third Os Cuneiforme. On its interior ſide, it is joined to the convex ſide of the great Os Cuneiforme by two ligaments. On its lower ſide it has four, whereof the firſt appears as if it were double, going from the tuberoſity of this bone to the baſis of the firſt Os Cuneiforme; the ſecond and third go obliquely to the other two Oſſa Cuneiformia; the fourth is a little tranſverſe, being fixed in the inferior internal angle of the Os Cuboides.

223 The Os Cuboides, beſides the ligaments which tie it to the aſtragalus, Os Calcis, and Os Scaphoides already mentioned, has others which connect it above, below, and on the outſide with the third Os Cuneiforme, and two laſt bones of the metatarſus. The ſuperior ligaments are almoſt equally flat, the inferior unequally thick, and ſtronger than the ſuperior. The exterior goes from the Os Cuboides to the tuberoſity in the baſis of the laſt bone of the metatarſus, and ſeems likewiſe to communicate with the third bone by ſome ligamentary fibres.

224. The three Oſſa Cuneiformia are fixed to the Os Scaphoides and Os Cuboides, by the ligaments above mentioned. They are connected together on the upper part by particular ligamentary planes which go more or leſs tranſverſely from one bone to another, being all joined to one common ligamentary plane which covers theſe three bones, and alſo the Os Cuboides. On the lower part they are joined by ſtronger and thicker ligaments. They are likewiſe connected by ligaments to the three firſt bones of the metatarſus.

225. The great Os Cuneiforme is joined on its upper, lower, and interior or convex ſide, to the baſis of the firſt metatarſal bone, by ligamentary fibres, which form almoſt a continued plane, the inferior part of which is ſtrong and thick, and appears to be double. It is likewiſe tied to the inſide of the baſis of the ſecond metatarſal bone, by a particular ligament.

226. It has likewiſe on the outſide of its inferior part three conſiderable ligaments more or leſs oblique; the firſt and ſhorteſt of which goes to the baſis of the ſecond meta-

tarſal bone, the ſecond to that of the third, and the third, which is the longeſt, to that of the fourth.

227. The bones of the metatarſus are connected together by their baſes and heads. The ligaments that go between the baſes are ſuperior and inferior. The ſuperior are flat and ſmall: the inferior ſtrong and thick, and as it were multiplied by entering the interſtices between the baſes.

228. The ligaments which go between the heads have nearly the ſame general diſpoſition. The inferior have this peculiar to them, that, by filling the ſpaces between the heads, they keep them at ſome diſtance from each other. The inferior portions of theſe ligaments are fixed in the angles at the lower part of each head. They are moreover ſtrengthened by their union and intertexture with the aponeuroſis plantaris as ſhall be ſaid hereafter.

229. The firſt phalanges of the toes are tied to the heads of the metatarſal bones, by a ſort of orbicular ligament, ſet round the edges of the cartilaginous portions of the head, and thoſe of the baſes of the phalanges.

230. In the four toes, next the great toe, the inferior part of theſe ligaments is very thick, and cruſted over as it were with the cartilaginous ſubſtance fixed to the baſis of the phalanges, and from thence continued over the head of the metatarſal bone next it. This ſubſtance grows hard with age, like a ſeſamoide bone.

231. Of theſe ſeſamoide bones, the great toe has two belonging to the firſt phalanx, which are the largeſt, the ſooneſt formed, and moſt conſiderable of all that go by that name. They are ſhaped like an olive, being about one third part of an inch in length, and about half as broad as long. They are joined by their anterior extremities, to the baſis of this phalanx, cloſe by each other, and lie in the two depreſſions, on the lower ſide of the head of the firſt metatarſal bone.

232. The ſecond and third phalanges of all the toes being articulated by ginglymi, have lateral ligaments, which go between the ſides of the baſes, to the ſides of the heads. At the inferior edges of all theſe baſes, there is a cartilaginous matter, joined to the ligaments, which hardens with age, in the ſame manner as thoſe of the firſt phalanges.

233. The capſular ligaments of all theſe articulations are

diſpoſed in the ſame manner as in the firſt bones of the tarſus already deſcribed.

234. The annular ligaments and ligamentary vaginæ, found on the ſurface of many of theſe bones, contribute nothing to their connection, and therefore ſhall be explained in another place.

Perioſteum, marrow, and mucilaginous glands of the bones of the foot.

235. The perioſteum, which covers all theſe bones, is of the ſame kind with that of the bones of the leg.

236. The marrow is ſuitable to their internal ſtructure, that is, in moleculæ in the cavernous portions, and in maſſes in thoſe which have large cavities. Thus the marrow of all the tarſal bones is diſperſed in moleculæ, becauſe their internal ſtructure is ſpungy. In the metatarſal bones and firſt phalanges of the toes, it is diſpoſed in the ſame manner as in the tibia and fibula, that is, it lies in moleculæ in the extremities, the ſtructure of which is cavernous; but in the middle portions of them it lies in maſſes greater or leſs, according to the ſize of the cavities. In the other phalanges, which are entirely ſpungy, it is accordingly diſpoſed in moleculæ.

237. The mucilaginous glands anſwer in number and figure to the depreſſions between the cartilaginous edges and ligaments.

§ 2. *The freſh bones of the upper extremity.*

Cartilages of the bones of the ſhoulder.

238. The ſcapula in many ſubjects has a ſmall cartilaginous border along its whole baſis, which in children is remarkable enough, but in full-grown perſons it diſappears.

239. The glenoide cavity of this bone is covered with a cartilage, which is thicker toward the circumference than in the middle, and a little raiſed above the edge of the bone. This thickneſs of the cartilaginous circumference makes the cavity greater than it appears in the ſkeleton; and ſometimes in place thereof there is an additional border, which is thick at the circumference of the cavity, thin towards the bottom, and very narrow. It is of a pliable ſlippery ſubſtance, yet ſomething different from that of a cartilage, re-

ſembling, in ſome meaſure, the border of the cotyloide cavity of the Os Innominatum.

240. The ſmall cartilaginous ſurface of the acromion, mentioned in the treatiſe of dry bones, is thicker in the natural ſtate, and very little convex.

241. The ſmall triangular ſurface, at the extremity of the ſpine of the ſcapula, near the baſis, is covered with a very thin ſmooth cartilaginous lamina; but being tranſparent, it does not appear very white.

242. There are no other cartilages commonly found in the ſcapula, though we ſometimes obſerve in dry bones ſeveral places which ſeem to have been cartilaginous; but this is owing to the dried remains of ligaments and tendons.

243. The ſternal extremity of the clavicle is cruſted over with a cartilage, which is a little convex, and covers its whole triangular ſurface; beſides which, it has another moveable common cartilage, which ſhall be explained together with thoſe of the ſternum.

244. The ſmall cartilaginous ſurface of the humeral extremity of the clavicle, anſwering to that of the acromium, is much thicker in freſh than in dry bones, and appears like that of the acromium, to be a little convex.

245. Between theſe two cartilages of the clavicle and acromium, there is in ſome ſubjects a thin interarticular cartilage, very ſmooth on both ſides.

Ligaments of the bones of the ſhoulder.

246. The articulation of the acromium, with the extremity of the clavicle, is ſtrengthened quite round by ſeveral ſmall ſtrong ligaments, which go from one bone to the other. Theſe ligaments lie very near each other, and are withal ſo tightly braced over the joint, as to hide it altogether, and they appear more like a cartilaginous covering, than a ligamentary texture. The internal ſurface of theſe ligaments is lined with the capſula of the joint.

247. When the ſmall interarticular cartilage is found, its whole circumference is connected to theſe ligaments.

248. The articulation of the clavicle with the ſternum, is ſuſtained by ſeveral ligaments fixed by one end, round the pectoral extremity of the clavicle, near the edge of the triangular ſurface, and from thence paſſing over the interarti-

cular cartilage, are inſerted by the other end in the ſternum, in the manner hereafter to be related.

249. There is a long, narrow, ſtrong ligament, which goes from one clavicle to the other, behind the ſurca of the ſternum, being fixed to the internal angle of the contiguous extremities of the bones. It may be called *the interclavicular ligament.*

250. The neck of the ſcapula, at a ſmall diſtance from the edge of the glenoide cavity, gives inſertion to the capſular ligament or mucilaginous bag, and to the articular ligaments of the joint of the ſcapula and Os Humeri.

251. Beſides theſe articular ligaments of the ſcapula, there are three ligamentary cords fixed to the tuberoſity of the coracoide apophyſis, two of which, by their other extremities, are inſerted in the oblique eminence on the lower ſide of the humeral extremity of the clavicle; the third, under the acromium. There is likewiſe a thin flat broad ligament, reaching between the criſta of the ſpine of the ſcapula, and the edge of the inferior coſta.

Cartilages of the Os Humeri.

252. The cartilage by which the hemiſphere of the head of the Os Humeri is covered, is gradually thicker toward the middle than toward the edges.

253. The four ſurfaces of the tuberoſities which appear cartilaginous in dry bones, ſerve only for the inſertion of the tendons of four muſcles which move the Os Humeri on the ſcapula.

254. The channel or ſinus, between the two tuberoſities, is partly covered by a thin cruſt, which appears rather ligamentary than cartilaginous, and partly by a tendinous ſtratum, of which hereafter.

255. The trochlea and ſmall head of the lower extremity of the Os Humeri are covered by a common cartilage, in which the ſame proportion of thickneſs is obſervable, as in that of the upper extremities. This holds pretty generally of all the convex articular cartilages.

256. The foſſulæ near the pulley and ſmall head are covered with a kind of thin cartilaginous or ligamentary varniſh.

Ligaments of the Os Humeri.

257. The capſular or mucilaginous ligament looſely ſurrounds the whole articulation

of the ſcapula with the head of the Os Humeri. From its inſertion round the edge of the glenoide cavity already mentioned, it is continued over the hemiſphere of the head of the Os Humeri, and fixed near its edges, towards the muſcular ſurfaces of the great and ſmall tuberoſities.

258. Afterwards parting from them on both ſides, in the large ſpace left between the two tuberoſities, that is, between the ſmall tuberoſity and the loweſt ſurface of the great tuberoſity, it runs down gradually on the neck of the bone below the loweſt part of the cartilaginous hemiſphere.

259. In all this courſe, the capſula is cloſely fixed in the bone, except in the ſmall ſpace left between the two tuberoſities, that is, at the channel or ſinus already mentioned; where it forms a production like the tube of a funnel, proportioned to the capacity of the channel, and ſtrongly fixed in the upper portion thereof. This membranous tube is the vagina of the interarticular tendon of the biceps, which ſhall be deſcribed in the treatiſe of the muſcles.

260. The true ligament of this joint is, in ſome meaſure, of that kind mentioned N° 37. 38. that is, which ſeem to be made up of two ſorts of ligaments cloſely united together, *viz.* of a capſular ligament which ſurrounds the whole articulation, and of ſeveral true ligaments which run over, and cloſely adhere to the former at different diſtances.

261. Thus the capſula or mucilaginous bag of this articulation is in part ſtrongly united to four flat tendons inſerted in the two tuberoſities; and in part covered by true ligamentary bands, which, between the four tendons, and on both ſides of the firſt and laſt, form a conſiderable thickneſs. The reſt of the ſpace between the firſt or ſuperior plane of the great tuberoſity, and the ſmall tuberoſity, is ſo little provided with ligamentary fibres, that it has been believed to be altogether without them; and anatomiſts have ſatisfied themſelves with telling us, that in theſe places the orbicular ligament is very rough on the outſide, but ſhining and ſmooth on the inſide.

262. The interarticular tendon of the biceps, which has been already mentioned in ſpeaking of the production of the capſular ligament of the head of the Os Humeri, and which is contained in the articulation much after the ſame manner as the interarticular ligament of the head of the Os Femoris,

ris, called improperly *ligamentum teres*, might be properly enough deſcribed in this place, but I chuſe to refer it to the muſcles.

263. On the body of the Os Humeri, there are two particular ligaments which I term *intermuſcular* or *lateral*, of the ſame kind with thoſe mentioned, No. 52. They are long, flat, thin, ſtrong, and narrow, fixed by one edge along the two lower thirds of the bone, and reaching to both condyles. They are braced pretty tight, and are very narrow at the upper part, but broader toward the condyles.

264. The lower extremity of the Os Humeri is joined to the bones of the fore-arm by two faſiculi of ligamentary fibres, one fixed to the internal condyle, the other to the external. Each faſciculus is compoſed of fibres cloſely joined together at the condyle, and afterwards parting in diſtinct bands like a gooſe's foot.

265. The capſular ligament is fixed to the condyles, and there covers them; and afterwards it is fixed round both ſides of this lower extremity above the foſſulæ. Its inſertion in theſe ſides is archwiſe, ſo that it is there at a much greater diſtance from the articulation than at the condyles. The foſſulæ are ſlightly varniſhed over with a cartilaginous ſubſtance.

266. This capſula appears to be ſtrengthened by a ligamentary web, the fibres whereof croſs each other in different directions; but we muſt not take for ligamentary filaments, ſome tendinous fibres of muſcles to which the capſula adheres very cloſely. It appears larger and looſer when the muſcles are ſeparated from it, than in its natural ſtate when cloſely united to the muſcles.

Cartilages of the bones of the fore-arm.

267. The two ſigmoide cavities in the upper extremity of the ulna are covered by a cartilage common to both, which is a little interrupted about the middle of the edges of the cavities by the tranſverſe notches mentioned in the treatiſe of dry bones. This cartilaginous cruſt ſeems to be thicker at the edges than in the middle.

268. The inferior extremity or ſmall head of the ulna, is cruſted over by a cartilage, round its cylindrical border, in the notch near the ſtyloide apophyſis, and for ſome ſpace on the apophyſis itſelf.

269. The cartilage which covers the head of the radius, is likewiſe ſtretched over the cylindrical border thereof; and a lateral portion of the muſcular tuberoſity immediately below the neck, is alſo covered with a thin ſhining cartilage.

270. All the concave ſide of the baſis of the radius is cartilaginous, and often divided by a ſmall cartilaginous prominent line. The lateral notch of the baſis is likewiſe covered by a continuation of the ſame cartilage.

271. The lateral half-grooves or channels of the baſis of this bone, appear likewiſe to be cruſted over with a cartilaginous matter; but this I rather take to be portions of the annular ligaments, which ſhall be hereafter deſcribed.

272. At the baſis of the radius there is likewiſe a particular additional cartilage, or triangular production longer than it is broad, very thin, and rather flat than concave on both its ſmooth ſides. It is fixed by its baſis, or ſhorteſt ſide, to the lateral ſigmoide notch of the baſis of the radius, in ſuch a manner as that one ſide of it is on a level with the large cartilaginous ſurface of the baſis of the bone, and its apex directly oppoſite to the ſtyloide apophyſis. The other ſide touches the flat extremity of the ſmall head of the ulna, but is not fixed to it.

273. This cartilage is one of thoſe mentioned, No 26. 27. and may be termed the *interarticular cartilage* of the joint of the wriſt. It is tied to the radius by very ſhort ligaments, and ſliding on the ſmall head of the ulna, it follows all the motions of the radius. It is therefore a ſort of articular production of the lower ſide of the baſis of the radius, and fills, in the natural ſtate, the void ſpace which in the ſkeleton appears between the end of the ulna and the neighbouring bone of the carpus.

Ligaments of the bones of the fore-arm.

274. Some of the ligaments of the bones of the fore-arm are common to them with the Os Humeri, ſome common to them with the bones of the hand; and ſome are proper. Theſe laſt are two in number, one called the *interoſſeous ligament* of the fore-arm, and one which may be termed the *coronary ligament* of the radius. To theſe may be added the annular ligaments, which only ſerve for the paſſage of tendons; and other ligamentary expanſions, which may be called *muſcular ligaments.*

275. The interoſſeous ligament of the fore-arm is very like that of the leg. It is fixed by one edge, along the ſharp angle of the ulna, and by the other along that of the radius. It is principally made up of two very ſtrong planes of fibres, which croſs each other at oblique angles, and leave holes at different diſtances for the paſſage of the blood-veſſels.

276. This ligament ties the two bones cloſely together, and the two planes ſerve for the inſertion of ſeveral muſcles. In the ſupination of the hand it is very tightly braced, but in pronation it is folded a little lengthwiſe.

277. The coronary ligament of the radius, is a ſort of ligamentary hoop ſurrounding the circular circumference of the head of that bone, reaching from one ſide of the ſmall lateral ſigmoide or tranſverſe cavity of the ulna, to the other, in an arch, which is about three quarters of a circle. It is very ſtrong, and comes near the ſolidity of a cartilage. The ſide next the radius is very ſmooth; and though it connects that bone very cloſely to the ulna, yet it leaves it room enough to turn in the motions of pronation and ſupination.

278. The capſular ligament of the joint of the elbow runs down from its inſertion in the Os Humeri already deſcribed, and is fixed in the olecranum round the edge of the great ſigmoide cavity, including both the apex of the olecranum and of the coronoide apophyſis. It likewiſe runs over the head of the radius, and is fixed to the coronary ligament, quite round. Thus it completely ſurrounds the articulation of theſe three bones, and ſerves to contain the mucilaginous liquor furniſhed by the glands and fatty ſubſtance, both which are found in the greateſt quantities near the extremity of the ulna.

279. The true common ligaments by which the Os Humeri is connected to the bones of the fore-arm, called *lateral ligaments*, are the two faſciculi, which, after being inſerted in the condyles of the Os Humeri, are expanded like a gooſe's foot. That which is fixed in the inner condyle, may be called *brachio cubitale*, and the other *brachio-radiale*.

280. The brachio-cubital ligament running down over the capſula to which it cloſely adheres, below the great edge of the trochlea of the Os Humeri, is inſerted like radii (of which its other extremity fixed in the condyle is the centre) on the

ſide of the great ſigmoide cavity of the ulna. It is covered on the outſide by ſeveral tendons which adhere cloſely to it, and ſeem to ſtrengthen it.

281. The brachio-radial ligament is diſpoſed much after the ſame manner, but is of a greater extent. It is expanded from the external condyle of the Os Humeri, as from a centre, and is inſerted round the coronary ligament, and from thence all the way down to the neck of the radius, and alſo in the neighbouring parts of the ulna. Through all this paſſage it covers the capſular ligament, and is covered by ſeveral tendons, adhering cloſely to both.

282. Of the ligaments by which theſe bones are connected to thoſe of the hand, one is, like a roundiſh cord, fixed in the ſtyloide apophyſis of the ulna, and from thence paſſes directly over the Os Cuneiforme of the carpus, in which and in other bones it is inſerted in the manner that we ſhall afterwards explain: another pretty broad ligament is fixed in the point of the radius, and by its other extremity in the bones of the carpus.

283. From this ſtyloide ligament of the radius, along each edge of the baſis of that bone, are ranks of ligamentary fibres lying much in the ſame direction with the ligament itſelf, and continued all the way to the ſtyloide ligament of the ulna; thoſe neareſt the ulna incloſe the interarticular cartilage of the baſis of the radius, and near the ſtyloide ligament of the ulna, there is a particular faſciculus inſerted in the point of that cartilage.

284. All theſe ligaments ſurround and cover the capſular ligament ſo cloſely, that they can hardly be diſtinguiſhed from it. The capſula is likewiſe in part covered by a portion of a great oblique ligament, which being by a very broad inſertion fixed in the large extremity of the radius, about two fingers breadth above the ſtyloide apex, afterwards croſſes obliquely, partly over the convex ſide of the baſis radii, and partly over that of the carpus, and then turning toward the Os Orbiculare, is inſerted therein. It is called *the external tranſverſe ligament* of the carpus, and may likewiſe be named *the great oblique ligament* of the wriſt.

285. There are ſeveral ſmall annular ligaments placed at different diſtances on the convex ſide of the baſis radii, from

its ſtyloide apex to its articulation with the extremity of the ulna. They are at leaſt ſix in number, ſome of them being often double or triple.

286. The firſt is fixed in the ſtyloide apex; the ſecond in the groove near that apex; the third in the ſmall narrow or middle groove; the fourth in the groove next the former; the fifth in the corner of the ſemilunar notch of the baſis, at its articulation with the ulna; and the ſixth in the extremity of the ulna near the ſtyloide apophyſis.

287. Theſe particular ligaments are almoſt wholly covered by the great oblique ligament already mentioned, and are fixed as ſtrongly in it by one ſide, as they are in the bones by the other. They are all very ſtrong, and their concave ſides ſerving for fræna to the tendons of ſeveral muſcles that paſs over them, are very ſmooth, and accompanied with thin mucilaginous vaginæ, which ſhall be deſcribed in the treatiſe of the muſcles.

288. To theſe we might add the ligamentary expanſions, with which ſeveral muſcles are covered, and ſeparated from each other, as by ſo many diſtinct ſepta, which are all very thick and ſtrong where they are inſerted in the bones. One kind of them may be termed *ligamentary bands*, or *muſcular vaginæ*, the other *ligamentary ſepta*, *intermuſcular ligaments*, &c. but the deſcription of them muſt be referred to that of the muſcles.

Cartilages of the bones of the hand.

289. All the bones of the carpus, metacarpus, and fingers, are cruſted over with cartilages at theſe places which I termed *cartilaginous ſurfaces*, in the treatiſe of dry bones; but in freſh bones they are thicker, ſofter, and whiter than in the ſkeleton. In adult ſubjects their figure remains the ſame in both, but it changes in the dry bones of younger ſubjects, and in thoſe of children it is quite different. The impreſſions and notches in which the mucilaginous glands are lodged, are moſt ſenſible in the cartilages of freſh bones, becauſe of their thickneſs.

Ligaments of the bones of the hand.

290. The ligaments of the carpus are very numerous. Some of them tie each bone to one or two neighbouring bones in the ſame rank; and theſe are compoſed of a great number of filaments, but ſo very ſhort as to allow theſe bones only a ſmall degree of motion. Some of them tie the bones of one row to thoſe of

the other, which are likewiſe made up of many filaments, but not ſo ſhort as the former, and therefore allow theſe bones a more manifeſt motion, as we ſee in bending the wriſt. Laſtly, there are other ligaments of the carpus, by which the three firſt bones of the firſt row are connected to the bones of the fore arm; and to theſe may be added the ligaments by which the bones of the ſecond row are joined to thoſe of the metacarpus and firſt phalanx of the thumb.

291. We have already deſcribed all the ligaments belonging to the articulation of the carpus with the bones of the fore-arm, except their inſertions in the carpus. The ſtyloide ligament of the radius is fixed round the neighbouring tuberoſity of the Os Scaphoides. The ſtyloide ligament of the ulna is fixed firſt in the Os Cuneiforme, and then in the Os Unciforme, from whence it is a little ſtretched over the fourth bone of the metacarpus.

292. The ligaments which lie between the two former, round the baſis of the radius, and a ſmall portion of the head of the ulna, are fixed round the common convexity of the three firſt carpal bones, as is alſo the mucilaginous capſula by which theſe ligaments are lined.

293. Beſides all theſe ſmall ſhort ligaments belonging to each bone in both rows, the rough ſurfaces of all the bones, eſpecially thoſe which form the convexity of the carpus, give inſertion to a great many ligamentary faſciculi, ſtretched over and cloſely united to the former ſmall ligaments, and ſerving probably to ſtrengthen them. Some faſciculi of the ſame kind are found on the concave ſide of the carpus, but they are fewer in number, and not ſo ſtrong.

294. There is likewiſe a conſiderable ligament, called the *inner tranſverſe ligament* of the carpus. It was formerly called *an annular ligament*, and may ſtill very juſtly retain that name, in the ſenſe already explained, when I ſpoke of ligaments in general.

295. The bones of the metacarpus, beſides the ſhort ligaments by which they are tied to the ſecond row of the bones of the carpus, have ſeveral others, by which both their baſes and heads are connected together. The baſes of the third and fourth bones are not ſo cloſely tied as the reſt, and therefore they have a very ſenſible motion, which, however, is greater in the fourth than in the third.

296. The heads of theſe bones are firmly tied to each other by a ſtrong tranſverſe ligament ſituated in the palm of the hand, and fixed by diſtinct productions in the neighbouring part of the heads, in ſuch a manner, as to form, in the ſpaces between the heads, a kind of perforated fræna, through which the tendons of the flexor muſcles of the fingers have a free paſſage; and theſe fræna are alſo ſupported by aponeurotic expanſions, which ſhall be deſcribed in the treatiſe of the muſcles.

297. The firſt phalanx of the thumb is fixed to the Os Trapezium, by ſhort ligaments which paſs obliquely over the articulation. The firſt phalanges of the other four fingers are joined to the heads of the metacarpal bones almoſt in the ſame manner, and by ligaments like the former, which are ſtrengthened by adhering to the tranſverſe ligament already mentioned. The ſecond phalanx of the thumb is joined to the firſt by ligaments of the ſame kind.

298. The third phalanx of the thumb is joined to the ſecond; the ſecond phalanges of the other fingers to the firſt, and the third to the ſecond, by lateral ligaments, almoſt in the ſame manner as the bones of the fore-arm to the Os Humeri; that is, theſe ligaments ſpread from a point fixed in the lateral tubercles of the heads of the phalanges, and are inſerted by their other extremity like radii in the baſes of the neighbouring phalanges.

299. The two firſt phalanges of each finger have a very ſtrong ligamentary vagina inſerted in the rough lines or ridges, on their flat ſides. Theſe vaginæ are lined with a mucilaginous membrane, which runs like a tube from one phalanx to the other, over the articulation. They ſerve for fræna to the flexor muſcles of the fingers, the tendons of which paſs through them.

§ 3. *The freſh bones of the trunk.*

Cartilages of the ſpine.

300. The cartilages of all the vertebræ in general are of two kinds; one proper to each vertebra, the other common to the two vertebræ that lie next each other. The firſt I term *cartilages of articulation*, the others, *cartilages of ſymphyſis*.

301. The proper articular cartilages of each vertebra of

the whole ſpine are thoſe four which cover the ſurfaces of the four ſmall articular apophyſes. In the natural ſtate they are very white and ſmooth, and much thicker than in dry bones. Their circumference is the ſame with that of the articulated ſides of the apophyſis, except in thoſe places where there are ſmall ſuperficial notches. In the firſt vertebra of the neck and vertebræ of the loins theſe cartilages are thicker than in the reſt.

302. The two inferior articular cartilages of the firſt vertebra, and the two ſuperior cartilages of the ſecond, ſeem to be diſproportionate, though not ſo much as in dry bones; and in ſome ſubjects we find moveable or interarticular cartilages between the apophyſes of theſe two vertebræ.

303. The firſt vertebra of the neck has a ſmall cartilaginous incruſtation in the middle of the concave ſide of its anterior arch, anſwering to another on the foreſide of the odontoide apophyſis of the ſecond vertebra; ſo that theſe two vertebræ have five articular cartilages each, beſides the interarticular ones already mentioned.

304. The vertebræ of the back, beſides the four cartilages of their ſmall apophyſes, have others which do not belong to their articulations with one another, *viz.* thoſe that cover the lateral foſſulæ in the bodies of theſe vertebræ and the foſſulæ of their tranſverſe apophyſes, by both which they are articulated with the ribs.

305. The cartilages of ſymphyſis lie between the bodies of the vertebræ, one of them being contained between, and cloſely joined to the lower ſurface of the body of one vertebra, and to the upper ſurface of that next under the former; the breadth and circumference of them anſwering exactly to that of the ſurfaces to which they are connected; but their height or thickneſs is different in each claſs of the vertebræ. In the vertebræ of the loins they are a quarter or third part of an inch in thickneſs, according to the ſtature of the ſubject. In thoſe of the neck, they are not ſo thick, and the thinneſt of all are thoſe of the vertebræ of the back.

306. Theſe cartilages are not of an equal thickneſs in all their parts. Thoſe of the neck and loins appear to be thickeſt on the foreſide, and thoſe of the back, rather thickeſt on the backſide; but theſe differences are moſt remarkable in the vertebræ that lie near the middle of each claſs.

307. The internal ſtructure of theſe cartilages is different from that of all the other cartilages of the body, and indeed they reſemble the reſt in nothing but in whiteneſs and elaſticity. When we view their circumferences only, they ſeem to be one uniform maſs as the others generally are; but when they are divided by an inciſion parallel to the ſurface of the vertebræ to which they are joined, we ſee that they are made up of a great number of cartilaginous concentrical rings contained within each other, a ſmall diſtance being left between them. They are cloſeſt and thinneſt near the centre, and about the middle ſeem to degenerate into another ſofter kind of ſubſtance.

308. Theſe rings do not form an entire circumference, being turned inward on the backſide, anſwerably to the poſterior ſlope in the body of each vertebra. They lie horizontally, one edge being fixed to the lower ſide of one vertebra, and the other to the upper ſide of the vertebra next below the former. The interſtices between the rings are filled with a mucilaginous ſubſtance, leſs fluid than that of the joints; and their breadth or height is proportionable to the diſtance of the vertebræ between which they lie.

309. Each cartilaginous lamina taken ſeparately is very pliable according to its length, but taken altogether, they are not ſo eaſily bent, partly becauſe of their circular figure, and partly becauſe of their proximity and multiplicity. They yield, however, in the inflections of the ſpine; and their external ſurface, which in the ordinary ſituation of the ſpine is even with the ſurface of the vertebræ, becomes prominent, or jets out on that ſide toward which the inflection is made, the cartilages being then compreſſed by the vertebræ.

310. They likewiſe yield on all ſides, without any inflection of the ſpine, to the weight of the head and upper extremities; but this is done by very ſmall and imperceptible degrees, and moſt of all, when the upper parts of the body are loaded with any exterior weight.

311. They reſtore themſelves afterwards merely by being freed from compreſſion; ſo that a man is really taller after lying ſome time, than after he has walked or carried a burden for a great while; the moſt natural and ſimple reaſon that can be given for the different heights of the ſame perſon at different times, firſt obſerved in England, and afterwards

confirmed by M. Morand, a member of the royal academy of ſciences, being the different ſtate of the intervertebral cartilages.

312. The intervertebral cartilages of the neck, lying for the moſt part between the convex ſide of one vertebra, and the concave ſide of another, are of a greater extent in proportion to the ſize of theſe vertebræ, than thoſe of the back and loins. Without this convexity and hollowneſs in theſe vertebræ, which are the leaſt of all, the cartilages could not have been made large enough to be able to reſiſt ſtrains and great motions.

313. The Os Sacrum has no cartilage except that between the upper ſide of the firſt falſe vertebra, and the laſt vertebra of the loins, and thoſe by which it is connected with the Oſſa Innominata, already deſcribed.

314. The intervertebral cartilages of this bone in an adult ſubject, are too much obliterated to need a deſcription.

315. The cartilages which join the different portions of the Os Coccygis are preſerved in ſome ſubjects, to a very great age; in others they ſoon become entirely bony.

Ligaments of the ſpine.

316. The vertebræ are ſtrongly connected to each other by three kinds of ligaments. Each vertebra is connected to that above and below it, by a great number of very ſhort and ſtrong ligaments which croſs each other obliquely, and are fixed round the edges of the body of each vertebra.

317. Theſe crucial ligaments cover the circumference of the intervertebral cartilages, and adhere cloſely to them. They ſeem to be looſer in the cervical and lumber vertebræ than in thoſe of the back, and by that means yield to the cartilages in the different inflexions of the ſpine already mentioned.

318. The bodies of all the vertebræ, from the ſecond of the neck to the Os Sacrum, are covered by ligamentary half vaginæ on the convex ſide, in which theſe vaginæ are fixed, ſurrounding all the crucial ligaments, and made up of ligamentary faſciculi and filaments, partly oblique, but moſtly longitudinal.

319. All the vertebræ are likewiſe ſtrongly connected by a ligamentary tube, which lines the inner ſurface of the medullary canal from the occipital hole to the Os Sacrum, re-

preſenting a kind of long flexible funnel, its cavity at the upper part being equal to that of the occipital foramen; and ending in a ſmall point at the Os Sacrum.

320. This ligament is made up of ſeveral ſtrata of longitudinal and oblique fibres interwoven together, adhering cloſely to the inſide of the great foramen in each vertebra, by a great number of filaments detached from it to the porous ſubſtance of the vertebræ.

321. The firſt vertebra is not only fixed to the Os Occipitis by a portion of this ligamentary funnel, but alſo by a diſtinct and very ſtrong ligamentary covering, which ſurrounds and adheres very cloſely to that portion of the funnel. This covering is fixed above, round the great occipital foramen, where it begins to adhere to the funnel, and below, quite round the circumference of the firſt vertebra.

322. The ſecond vertebra has two ligaments peculiar to it, one which connects the apophyſis dentiformis to the Os Occipitis; and another tranſverſe, which confines this apophyſis within the anterior portion of the cavity of the firſt vertebra. The firſt may be termed *occipital*, and the ſecond the *tranſverſe ligament* of the odontoide apophyſis.

323. The occipital ligament is very ſtrong and thick, and adheres in a very ſingular manner to the three planes of the apex of the apophyſis, and is afterwards divided into two or three portions which are fixed in the like manner, in the anterior edge of the great occipital foramen, and in the inequalities of the apophyſis baſilaris near that hole.

324. The tranſverſe ligament may be ſaid more juſtly to belong to the firſt vertebra, both ends of it being inſerted in the lateral impreſſions of the inner ſurface of that vertebra mentioned in the deſcription of the ſkeleton. But it is ranked among the ligaments of the ſecond vertebra, becauſe of its uſe, and becauſe of the inſertion of its middle portion.

325. This thick ligament is ſtretched from one ſide of the inner ſurface of the firſt vertebra, to the ſecond. About the middle of the foreſide, its texture is very cloſe, and it is fixed by this portion in the back part of the apophyſis dentiformis; and ſometimes it ſeems to have additional faſciculi which adhere by one end to both extremities, and by the other, to each ſide of the apophyſis.

326. Along the whole bony canal of the ſpine, between

the baſes of each ſpinal apophyſes, lies a flat and very elaſtic ligament of a yellowiſh colour, which fills up the poſterior great notches of the vertebræ, adhering to their edges; and likewiſe to the neighbouring portions of the funnel or great ligamentary tube.

327. Between the extremities or apices of the ſpinal apophyſes we find ſmall ligamentary ropes which go from one ſpine to that next it; and which are really double, though they ſeem to be ſingle in the vertebræ of the back and loins. In the vertebræ of the neck, they are fixed ſeparately to the forked extremities of the ſpines.

328. Between all the ſpinal apophyſes, from their apices to the middle of the baſes, lies a ligamentary membrane going between each two apophyſes, and thereby diſtinguiſhing the right ſide of the vertebræ from the left. There is a ligament of the ſame kind between the tranſverſe apophyſes.

329. Theſe are intermuſcular ligaments or ligamentary ſepta, which divide the muſcles of one ſide from thoſe of the other, as was already obſerved in ſpeaking of the ligaments in genaral, and will appear more particularly in the deſcription of the muſcles. The firſt kind may be termed *interſpinales*, the other, *intertranſverſales*.

330. The articular ligaments of the ſpina dorſi, are thoſe which tie the glenoide cavities of the firſt vertebra to the condyles of the Os Occipitis; thoſe that join the cartilaginous ſurface of the apophyſes dentiformis, to the anterior cavity of the firſt vertebra; and thoſe by which all the oblique or articular apophyſes are connected together.

331. Theſe are all ſmall, ſhort, ſtrong ligamentary faſciculi, fixed by both extremities, round the cartilaginous ſurfaces of the apophyſes, ſurrounding very cloſely all the capſular ligaments of theſe articulations.

332. The vertebral ligaments of the ribs, or thoſe which connect the ribs to the bodies and tranſverſe apophyſes of the vertebræ of the back, are of the ſame kind, being inſerted round the cartilaginous foſſulæ, in the body and apophyſes of each vertebra.

333. Beſides all theſe ligaments of the ſpina dorſi, there is one which goes in form of a membrane, from the Os Occipitis, all the way to the laſt two vertebræ of the neck. It

is broad at the upper part, and from thence diminiſhes gradually. By its upper broad extremity, it is fixed along the occipital ſpine, and by one edge, in the poſterior tubercle of the firſt vertebra, between the two ſpinal furcæ of the following vertebræ, and in the apices of the ſpinal apophyſes of the loweſt vertebræ; but the other edge is looſe. This is a true intermuſcular ligament, and I give it the name of *ligamentum cervicale poſterius.*

334. There are two lateral ligaments of the ſame kind, fixed to the tranſverſe apophyſes of the vertebræ of the neck, which ſhall be deſcribed together with the muſcles.

335. The ligaments belonging to the Os Sacrum were deſcribed near the beginning of this account of the freſh bones.

Cartilages of the ſternum and ribs.

336. The ſternum of an adult ſubject has commonly ſixteen cartilages, fourteen of which are articular, the other two ſymphyſes. Of the articular cartilages, two belong to the articulations of the clavicula, and twelve to thoſe of the true ribs, from the ſecond to the ſeventh incluſively. The two ſymphyſes are thoſe between the ſternum and the firſt rib on each ſide.

337. There is likewiſe another ſymphyſis by which the upper portion of the ſternum is connected to the lower, the cartilage of which is often obliterated in an advanced age.

338. The apophyſis enſiformis is often bony toward the ſternum, and more or leſs cartilaginous at the other end. In very aged perſons it has been found entirely oſſified; and ſometimes wholly cartilaginous, even in adults.

339. All the ribs have cartilaginous portions, which differ from each other in length, breadth incurvation, adheſion, and in their extremities, all which were explained in the deſcription of the ſkeleton. We have only to obſerve here, that theſe cartilages are whiter, more poliſhed, broader, and thicker in the natural ſtate than when they are dried.

340. The cartilages of the falſe ribs are naturally more ſlender and pliable than thoſe of the true ribs, the middle or inner ſubſtance of which acquires the conſiſtence of bones in old age, and their extremities ſometimes oſſify, and are immoveably fixed to the ſternum.

341. The ſternum has ſeveral ligaments by which it is connected

Ligaments of the ſternum and ribs.

connected with the clavicles and ribs. It is joined to the clavicles by ſtrong ſhort ligaments, fixed by one extremity round the edges of its two ſuperior notches, by the other, in the extremity of each clavicle, and by the middle, to the interarticular cartilages already explained, ſurrounding the particular ligaments which go between the edges of theſe cartilages and the ſternum, and the capſular ligaments between them and the clavicles.

342. All the ribs are connected to the bodies of the vertebræ by ſtrong ſhort ligamentary faſciculi, fixed by one end round the foſſulæ in the vertebræ, and by the other round the head of each rib. The ribs are likewiſe tied to each other by thin ligaments, which go obliquely from the cartilage of each rib to that of the next.

343. The ten uppermoſt ribs on each ſide are connected to the tranſverſe apophyſes of the vertebræ of the back, by ſtrong ſhort articular ligaments fixed to the tuberoſities of the ribs, and round the foſſulæ of the apophyſes, much in the ſame manner with thoſe which go between the heads of the ribs and bodies of the vertebræ. Both theſe articulations are provided with capſular ligaments.

344. The eleventh rib on each ſide, having no articulation with the tranſverſe apophyſes, is connected to them by auxiliary ſtrong ſhort ligaments fixed in its neck.

345. The laſt rib is only joined by its head to the body of the twelfth vertebra of the back; but it is connected in a particular manner to the tranſverſe apophyſis of the firſt vertebra of the loins, by a broad ligament fixed in the whole upper edge of the apophyſes, and in the lower edge of the rib through about two thirds of its length.

346. The firſt true rib has no ligamentary connection with the ſternum, the cartilaginous ſymphyſis being ſufficient. The reſt are cloſely joined to that bone by ſmall ligamentary portions, fixed by one end round the extremity of the cartilage, and by the other, round the notches in the ſternum. On the upper and lower ſides of each articulation, theſe ligaments are very ſhort, but on the foreſide they are expanded over the ſternum in a radiated manner.

347. The cartilage of the firſt falſe rib is joined to that of the laſt true rib, by ſeveral ſhort filaments, which go

from the lower edge of the one to the upper edge of the other, near its ſmall extremity. The other falſe ribs are connected together much in the ſame manner, with this difference only, that the filaments by which the fourth rib is connected to the third, are longer than thoſe above them; and thoſe between the fifth rib and the fourth much longer than any of the reſt; and for this reaſon theſe two ribs are leſs ſteady than the others.

The perioſteum, marrow, and mucilaginous glands of the vertebræ, ſternum, and ribs.

348. The ligamentary expanſions of the vertebræ are in place of a perioſteum, both outwardly and inwardly. The ſternum and bony portions of the ribs have a perioſteum like the other bones. The cartilaginous portions of the ribs are covered by a membrane of the ſame kind, termed *perichondrium*. As the internal ſtructure of theſe bones is cellulous or ſpungy, they contain only ſmall ſeparate portions of marrow, or a red medullary juice, like that in the vertebræ.

349. The mucilaginous glands of all theſe articulations are very ſmall, but are accompanied by many fatty moleculæ lying round each joint. The inner ſurface of the ligamentary tube which lines the bony canal of the ſpine, is lubricated by an oily or adipoſe ſubſtance, which ſhall be ſpoken to in the deſcription of the brain.

§ 4. *The freſh bones of the head.*

Cartilages.

350. The condyloide apophyſes of the Os Occipitis, the glenoide cavities or articular foſſulæ of the Oſſa Temporum, the eminences next theſe cavities, and the condyloide apophyſes of the lower jaw, are all cruſted over with very white and ſmooth cartilages; and there is likewiſe an interarticular or moveable cartilage in each articulation of the lower jaw, with the temporal bones.

351. This cartilage is thick near the circumference, very thin and tranſparent, and ſometimes perforated in the middle. The lower ſide is uniformly concave, anſwering to the oblong convexity of the maxillary condyle; but the upper ſide is partly concave, and partly convex, ſuited to the foſſula and eminence in the temporal bone. The mechaniſm

of this cartilage ſhall be explained in the deſcription of the muſcles.

352. The remaining cartilages of the bones of the head, *viz.* the cartilaginous ſeptum and other cartilages of the noſe; the ſmall cartilaginous ring in each orbit; the cartilages of the outward ear; and thoſe which are joined to the Os Hyoides, muſt be referred to the deſcription of the viſcera.

353. The ligaments of the bones of the head are theſe. *Ligaments.* (1.) Thoſe between the occipital condyles and the ſuperior apophyſes of the firſt vertebra of the neck. (2.) Thoſe between the Os Occipitis and apophyſis dentiformis of the ſecond vertebra. (3.) Thoſe of the articulation of the lower jaw with the temporal bones. (4.) Thoſe by which the Os Hyoides is connected to the ſtyloide apophyſes. I here paſs over the ligaments which connect the cartilages of the ear, thoſe of the noſe, the ſmall cartilaginous pulleys of the orbits, and the ciliary cartilages.

354. The ligaments of the occipital condyles reſemble the articular ligaments of the vertebræ, conſiſting of a ſtrong texture of ligamentary filaments placed cloſe by each other round the whole articulation, and fixed by one end in the occipital bone, by the other in the edges of the ſuperior apophyſes of the firſt vertebræ, and ſurrounding the capſular ligaments.

355. The ligaments which go from the Os Occipitis to the apophyſis dentiformis, are very thick, and diſpoſed in ſeparate faſciculi which afterwards unite. The faſciculi are fixed immediately before the great occipital foramen, in the lower ſide of the apophyſis baſilaris, and the united ligament is inſerted in the odontoide apophyſis in the manner already ſaid.

356. The ligaments of the articulation of the lower jaw are very ſtrong, and are diſpoſed and inſerted much in the ſame manner with thoſe by which the clavicle is connected to the ſternum. They are fixed by one extremity round the glenoide cavity or articular foſſula and eminence of each temporal bone, by their middle, round the interarticular cartilage, and by the other extremity, round each condyle of the lower jaw. The diſpoſition of the capſular ligament

with reſpect to the interarticular cartilage, is the ſame as in the articulation of the clavicle with the ſternum.

Perioſteum, marrow and mucilaginous glands,

357. The bones of the head, as well as all the other bones of the human body, are covered by a particular membrane, of which that part which belongs to the ſcull, is termed *pericranium*, and that which covers the bones of the face, or of the two jaws, is called ſimply *perioſteum*. This membrane ſhall be more particularly deſcribed among the other ſoft parts of the head.

358. The internal ſtructure of the bones of the head being for the moſt part cellulous, they contain alſo diſtinct portions of marrow included in membranous cells lying in the diploë.

359. The ſinus frontales, maxillaris, and ſphenoidales, are lined with a glandulous membrane which ſecretes a mucilage very different from that of the joints, as we ſhall ſee in another place.

360. The true mucilaginous glands of the occipital and maxillary articulations, have nothing peculiar to them. They are proportioned to the joints to which they belong, and lie between the capſular ligaments and circumference of the cartilages.

SECT. III.

A deſcription of the Muſcles.

ART. I.

The general doctrine of the Muſcles.

Situation in general.

1. ALL the motions of the human body, whether general or particular, whether natural or preternatural, are immediately performed by organs which anatomiſts name *muſcles*; and theſe are found in all the moveable parts of the body. I do not here ſpeak of motions cauſed merely by the elaſticity of certain parts, by external impulſes, or by the force of gravity.

External conformation.

2. The muſcles in general are bundles of fibres of different figures and ſizes, and for the moſt part conſiſting of two different portions; one whereof is thick, ſoft, more or leſs red, and ſometimes pale, forming what is called the *body*, *fleſhy ſubſtance*, or *belly* of the muſcle. The other is thin and ſmall, of a cloſe contexture and very white, forming the extremities and other parts termed by anatomiſts *tendons* or *aponeuroſes*. The fleſhy portion is the principal and eſſential part of the muſcle, being never wanting; but the tendinous or aponeurotic portion is in ſome muſcles ſo very ſmall as to be inviſible. Both portions are covered by a particular membrane.

Diviſion.

3. The ancients who compared a muſcle to a rat or other animal flead, divided it into the head, belly, and tail; but the moderns finding this compariſon very lame and faulty, have left off the uſe of all the terms ariſing therefrom except that of belly; and inſtead of the other two, they uſe thoſe of beginning or origin, and inſertion. Some of the lateſt authors think it moſt proper to call one end of the muſcle, the *fixed point* or *fulcrum*, the other the *moveable point*.

4. All theſe terms, whether old or new, tend to miſlead

us, and that of fulcrum is without foundation. The beſt and moſt ſimple diviſion of a muſcle is into the body or fleſhy portion, which in ſome muſcles may be termed the *belly*, and the extremities, whether tendinous, aponeurotic, or fleſhy.

Internal ſtructure.

5. The fibres, of which a muſcle is made up, go by the general name of *moving fibres*, and each of them, as well as the whole muſcle, is partly tendinous and partly fleſhy. They are for the moſt part ranked in faſciculi, in a lateral ſituation with reſpect to each other, and diſtinguiſhed by membranous, cellular or adipoſe ſepta, as by ſo many particular vaginæ.

6. Theſe fibres are conected to each other, and to the intermediate ſepta by a great number of very ſmall fine filaments, the capillary extremities of arteries, veins, and nerves running over them; and they are incloſed in a thin, membranous, cellular covering, called the *proper membrane* of the muſcle, being a continuation of the ſepta or vaginæ already mentioned.

7. All theſe ſepta or vaginæ communicate with each other, by a mutual and reciprocal continuation of their cellulous texture, and they are bound down tranſverſely by filamentous or fibrous pellicles, which croſs them at ſmall diſtances from one another, and lie nearly in the ſame direction through the whole body of the muſcle. The ſame ſort of fræna are obſervable between the moving fibres, which connect them together, and appear to be in ſome meaſure nervous.

8. The particular ſtructure of each moving fibre is not as yet ſufficiently known. They may all be divided into ſeveral ſmaller fibrillæ; and the ſubſtance of their fleſhy portion is believed by ſome to be cellulous, by ſome to be veſicular, and by others to be ſpungy or medullary. Some of the ancients imagined this portion to be hollow, and that it contained a ſort of pulp called by them *tomentum*, more or leſs ſaturated with blood.

9. When we examine a moving fibre through the beſt microſcopes, both the fleſhy and tendinous parts of it appear contorted, but the latter not ſo much as the former. Having injected any coloured penetrating liquor, we may, by the help of an ordinary microſcope, diſcover a very fine and cloſe vaſcular net-work which inſinuates itſelf between all the

fibres, covering or being twiſted round them, and likewiſe ſpread on the ſepta.

10. The fleſhy portion may be contracted or ſhortened, and relaxed or elongated. The tendinous portion yields but very little, reſiſting any force tending to prolong it, except it be ſo violent as to diſorder its texture.

11. The diſpoſition of the moving fibres is different in different muſcles, and their tendinous and fleſhy portions do not always lie in the ſame ſtraight line, but make oppoſite angles with each other. In ſome muſcles the fleſhy portion is not all of the ſame length, in others it is nearly equal, but the fibres unequally and gradually diſpoſed at the ſides of each other, forming all together an oblique plane.

12. Some are diſpoſed like radii, other form planes more or leſs incurvated; and ſome form complete circumferences, the two extremities meeting and uniting together.

13. The tendinous portions being only the ſupplement of the whole length of the muſcle, may be of equal or unequal lengths, according to the diſpoſition of their inſertions. They may be very ſhort at one end of the muſcle, and very long at the other. When the fleſhy plane is partly oblique, they vary gradually in length; and when that obliquity is reciprocal at both ends, in form of a lozenge, the tendinous portions are alternately long and ſhort.

14. In ſome muſcles, each moving fibre is nearly of the ſame length with the body or belly of the muſcle; in others the fleſhy fibres are very ſhort, though the body of the muſcle formed by them be very long. In the firſt kind, the fibres run more or leſs ſtraight from one end to the other, and are never very numerous. In the ſecond they are ſituated obliquely, and are conſequently in great numbers; ſo that the length of each fibre is not always to be meaſured by that of the body of the muſcle to which it belongs.

15. Theſe different portions of fibres are not equally to be met with in all muſcles. Some have two or more tendons, ſome only one, but of different lengths; others have none at all, or at leaſt none that can be perceived, as has been already ſaid.

16. But there is no muſcle without a fleſhy portion, which, alone being capable of contraction, is abſolutely neceſſary;

whereas the tendons in many places are only productions, by which the muſcles are fixed to parts at a diſtance from them.

17. Many muſcles are obſerved to be covered by an aponeurotic expanſion, of different degrees of ſtrength and ſize, which ſeems to ariſe from one or more of the neighbouring tendons. In proportion as it is extended it grows thinner, and then loſes itſelf in the cellular membrane, called formerly the *common membrane* of the muſcles.

18. There are likewiſe ſtrong ligamentary membranes of another kind, by which many muſcles are covered as by a girth, and which may be termed *broad* or *ligamentary bands* or *coverings*. They are made up of ſeveral planes of ſtrong white ſhining fibres, croſſing each other, and they are ſtrongly fixed along one or more bones, almoſt in the ſame manner as the interoſſeous ligaments of the fore-arm and leg. They furniſh ſepta or common vaginæ to the muſcles which they cover, and likewiſe particular vaginæ to the tendons, thinner than thoſe of the fleſhy portions.

19. Theſe common bands and vaginæ ſerve to gird and confine the muſcles, and to keep them in their places in great efforts. They likewiſe in ſome meaſure ſupply the place of tendons, and multiply the inſertions. The looſe portions of theſe membranes are lined on the inſide with other very fine membranes, which are continually moiſtened by a mucilaginous liquor, to preſerve the muſcles and tendons contiguous to them, from friction.

20. Beſides theſe bands and ſepta there are other ligamentary fræna peculiar to the long tendons, called by the name of *annular ligaments*, the general hiſtory of which is to be found in the deſcription of the freſh bones.

21. The difference of muſcles is very conſiderable, and depends on many circumſtances, the chief of which are the ſize, figure, direction, ſituation, ſtructure, connection, and uſe; and it is from theſe differences that the names of the greateſt part of the muſcles are taken. From their ſize they are termed *great*, *middle*, *ſmall*, *long*, *broad*, *thin*: from their figure, *triangular*, *ſcalenous*, *ſquare*, *rhomboidal*, *indented*, *orbicular*, *deltoide*: from their direction, *ſtraight*, *oblique*, *tranſverſe*: from their ſituation, *ſuperior*, *inferior*, *external*, *internal*, *anterior*, *poſterior*, *right*, and *left*: theſe four differences, and the names derived from

Difference, and names.

from them, are eaſily comprehended; but what relates to the other three, requires a little farther explication.

22. With reſpect to their ſtructure, muſcles are either ſimple or compound. Simple muſcles are thoſe whoſe fleſhy fibres, or rather the fleſhy portions of their moving fibres, are all uniformly diſpoſed, and terminate in tendons lying either in a ſtraight or oblique line, in the manner already explained

23. Compound muſcles are thoſe whoſe fleſhy fibres are diſpoſed obliquely in ſeveral particular ranks, repreſenting the ſame number of ſimple muſcles with their fibres lying in oppoſite directions. In proportion to the number of theſe ranks or ſeries, the muſcle is ſaid to be more or leſs compounded.

24. When the compound muſcle is made up of two ſimple muſcles only, theſe are ſo diſpoſed as to repreſent a feather, and the compound muſcle is from thence termed *penniform*. In ſome of theſe muſcles one of the tendons appears to be ſlit or divided, in order to contain the fleſhy portion between its two parts, while the other runs through the body of the muſcle, diminiſhing gradually in ſize as it advances, in the ſame manner as we ſee in a feather. In others there is only one middle tendon between the ſeries of fleſhy fibres, which are by their other extremity fixed to other parts. In more compound muſcles, the tendons at one extremity may all unite together, while thoſe at the other remain divided.

25. But there are ſtill other kinds of compound muſcles. Some are made up of two placed endwiſe, and joined together by a common tendon; ſo that this tendon, the two muſcles, and the two tendons at their extremities, lie all in a line, and form the whole length or extent of the compound muſcle, which is termed *digaſtricus* or *biventris*; and if three muſcles be thus joined, the compound is called *trigaſtricus*.

26. Some are made up of two muſcles more or leſs in a lateral ſituation with reſpect to each other, and united at one extremity; others are made up of three or four muſcles ſituated in the ſame manner; and if they are united at that extremity, which the ancients called the *head of the muſcle*, they are called *bicipites*, *tricipites*, &c. according to the number of theſe heads; but if they are joined at the other extremity, they are termed *bicornes*, *tricornes*, &c.

27. The muſcles are fixed by their extremities to different parts, and in different places of the human body. The greateſt part of them are inſerted in bones alone. Some are fixed partly to bones and partly to cartilages, as thoſe of the ear and noſe; ſome partly to bones, and partly to the integuments, as ſeveral muſcles of the face, which may therefore be termed *ſemicutaneous*, in imitation of thoſe in brutes, which being inſerted in the integuments alone, are from thence termed *cutaneous*. In ſome the fibres make an entire circle, without terminating any where by their extremities; of this kind are ſeveral of thoſe called *ſphincters*, to which may be added the heart, ſtomach, and inteſtines. All the muſcles have likewiſe a ſort of connection with the neighbouring parts, but this is only lateral by means of membranes.

Connection.

28. The names taken from the connections and inſertions of muſcles are generally of two kinds; one common and referred to ſome conſiderable part of the body, as when we ſay the muſcles of the head, of the thorax, abdomen, arm, leg, eye, lips, *&c.* the other proper, ſpecifying more particularly the inſertions of each muſcle, as the maſtoideus, ſterno-maſtoideus, coraco-brachialis, anconeus, peroneus, &c. Some names have no relation to the inſertions, as thoſe of ulnaris and radialis, which are given to muſcles which lie upon the ulna and radius, without being inſerted in either bone.

Names.

29. The names of the firſt kind relate more to the uſes of muſcles than to their inſertions, and are for the moſt part ill founded, and apt to miſlead us, as will appear when we come to the uſes of the muſcles. The names of the ſecond kind are inſtructive, and thoſe of the third are tolerable.

30. The general uſe of the muſcles is to move all the parts of the body, whether hard, ſoft or fluid. Moſt of the hard and ſoft parts are moved by theſe powers being fixed to them, and they move the reſt without any ſuch inſertion.

Uſes.

31. The muſcles fixed by both extremities to hard parts reciprocally moveable, may accordingly move either part. Thus the muſcles inſerted by one extremity to the Os Humeri, and by the other to the ulna, may move the ulna upon the Os Humeri, and the Os Humeri upon the ulna.

32. Muſcles fixed by one extremity to hard parts, and by the other to ſoft parts, cannot perform theſe reciprocal motions, becauſe in this caſe the hard parts muſt remain immoveable, the ſoft parts only being moved, as in the muſcles of the ball of the eye, thoſe of the lips, *&c.*

33. The fluids, of whatever nature or conſiſtence they be, are moved in ſome caſes by being immediately puſhed or projected by the muſcles, as we ſee in the heart, in others by their canals being preſſed upon, as in the oblique and tranſverſe muſcles of the abdomen; and there are other muſcles which ſtop or retard the motion of the fluids at one time, and facilitate or accelerate it at another, as all the ſphincters.

34. The uſe of each muſcle in particular is confined to the motion of one or more moveable parts; ſome parts require a certain number of muſcles to move them, whereof ſome act one way and ſome another. Several muſcles, for inſtance, move the Os Humeri upon the ſcapula, and of theſe ſome raiſe, others depreſs it; ſome turn it forward, ſome backward, and others round upon its axis, *&c.* In like manner the fore-arm is moved upon the Os Humeri by certain muſcles, whereof ſome extend and others bend it.

Enumeration and diſtribution.

35. The general enumeration of the muſcles of the human body which is commonly made, is founded on their ſuppoſed particular uſes. We meet with liſts of the muſcles of the head, of the thorax, abdomen, extremities, eye, noſe, lips, *&c.* and to the different muſcles ſaid to belong to each part, names are given, ſpecifying ſome determinate uſe; ſuch as *raiſers*, *depreſſors*, *adductors*, *abductors*, *flexors*, *extenſors*, &c.

36. This method of diſtributing and naming muſcles is very well ſuited to the memory, and may be retained for thoſe that are not entirely, or are not at all fixed to bones; but with reſpect to thoſe muſcles which are inſerted in bones alone, this way of talking is very capable of miſleading beginners, of begetting falſe ideas, of obſtructing the progreſs of knowledge, and even of making able philoſophers, phyſicians, and ſurgeons fall into conſiderable miſtakes.

37. It leads us naturally into ſeveral errors; as for inſtance, that the parts to which a certain number of muſcles is attributed, cannot be moved by other muſcles; that the muſcles

ſaid to belong to one part can move no other part; that the muſcles whoſe uſes are limited and determined by certain names, can have no other uſes; and that the muſcles ſo named may have the uſes aſſigned to them in all the different ſituations of the parts to which they are fixed. It is however abſolutely neceſſary for the ſake of memory, to divide the muſcles into claſſes, and afterwards to ſubdivide each of theſe claſſes.

38. To ſhun the inconveniencies already mentioned in the muſcles fixed only to bones, I diſcard the names taken from the parts to which theſe muſcles are commonly attributed, and from the uſes aſſigned to them: I retain as much as is poſſible the uſual names which expreſs only the inſertions or other circumſtances, that I may avoid all affectation of novelty; and when I find myſelf obliged to change a name, I ſet down the common name, after that which has appeared to me to be more natural and agreeable.

39. Thus, for inſtance, inſtead of this title, *The muſcles of the arm*, I put the following: *The muſcles that move the Os Humeri upon the ſcapula, and the ſcapula upon the Os Humeri*; and having deſcribed thoſe which are commonly mentioned, I add the reſt which may likewiſe move the part; and point out the uſes which the muſcles deſcribed may have, in moving other parts.

40. On this plan it will be neceſſary to deſcribe ſeparately all the muſcles which are wholly inſerted in bones, and not to explain their uſes till they have all been deſcribed, they being ſo nearly related to one another, that it is very difficult to ſpeak of the uſes of any one, without mentioning ſeveral others.

41. When ſeveral concur nearly in the ſame motions, they are termed *congeneres*; thoſe which act in oppoſite directions, are relatively and alternately called *antagoniſts*. Thus all the muſcles which extend or bend the fore-arm are congeneres; and thoſe which extend it are antagoniſts to the flexors; and theſe again reciprocally antagoniſts to the extenſors.

42. There muſt at leaſt be two muſcles to entitle them to the name of congeneres, but that of antagoniſt may be given to one muſcle as well as to ſeveral. Many muſcles contribute to the ſame motion without being congeneres, *viz.* where, by acting in an oblique direction, they produce a

third motion which is direct and determinate. This is termed a *combined motion*, and may be ſucceſſively continued in different directions, as that of the arm in turning a ſling, or the handle of any heavy machine. Laſtly, when all the antagoniſts on every ſide, or all the muſcles that move a part, act equally and keep the part fixed in a middle direction between all the motions of which it is capable, they are ſaid to be in a tonic motion.

43. To move any part, or to keep it in a determinate ſituation, all the muſcles belonging to it muſt co-operate, ſome of them drawing the part directly to the ſituation or attitude deſigned, ſome moderating this firſt motion by acting in a contrary direction, and others directing it laterally. The firſt kind of theſe muſcles I call *principal movers*, the ſecond *moderators*, and the third *directors*.

44. All theſe kinds are to be found in the articulations by enarthroſis, and in many of thoſe by arthrodia. The director muſcles are wanting in thoſe by ginglymus, being there unneceſſary. The moderators in general are the ſame with thoſe termed *antagoniſts*, and the want of their action is in many caſes ſupplied by the weight of the part to which they are fixed, or by the additional weight or reſiſtance of ſome other body.

Muſcular action.

45. The action of the muſcles in general, or, to ſpeak more properly, the mechaniſm of this action, conſiſts chiefly in the contraction or ſhortening of their fleſhy portion; by which the extremities of the muſcle are brought nearer to each other, and conſequently the parts are moved to which theſe extremities are fixed. It is, I ſay, the fleſhy portion alone which is ſhortened; the tendons always retain the ſame length, and only follow the motions of the other part, much in the ſame manner as in drawing a great weight by ropes fixed to it, where the arm alone is ſhortened, while the ropes only follow that motion.

46. The principal phænomena of muſcular actions are theſe: The fleſhy portion appears harder and more ſwelled in the time of action than of inaction, as may be readily perceived by touching it in both ſtates: the hardneſs of this ſwelling increaſes in proportion as the motion is continued, as is likewiſe evident by the touch; and it likewiſe increaſes by

merely adding to the weight or reſiſtance of the part moved, though its ſituation does not continue to be changed.

47. In many muſcles, this action may be determined to any degree of velocity and ſpace; that is, may be proportioned to the velocity and ſpace of the motion; may be increaſed and diminiſhed, accelerated, retarded, or ſtopped; and may be made to ceaſe in an inſtant, and be produced again in another inſtant.

48. During the contraction of a muſcle, its fibres are bent through their whole length, or formed into very ſmall fine folds in alternately oppoſite directions, as may be plainly ſeen in animals freſh killed, when the butchers cut their fleſh while it remains warm, though the blood has been let out, and the entrails removed. By opening living animals, and alſo in great wounds, the fleſhy fibres have been diſcovered to grow pale during their action, and to turn red again when at reſt.

49. To theſe phænomena we muſt likewiſe add, that where ſeveral muſcles are fixed to any moveable part, they are all in a ſtate of contraction, in every motion of that part; but they are not all in the ſame degree of action, becauſe the principal movers act more than the moderators and directors, or collateral muſcles, if any belong to the part. This cooperation of muſcles is eaſily perceived by touching them, when the part they belong to is moved with a conſiderable force. It muſt however be remembered, that I except the moderators or antagoniſts when any weight or aſſiſtance ſupplies their action.

50. Laſtly, there are ſome motions to which the muſcles, commonly believed to produce them, contribute nothing at all, but which depend ſolely on the relaxation of the antagoniſts to theſe muſcles, or thoſe that lie on the oppoſite ſide. This is ſeen evidently in ſupporting the body by one hand reſting on a low table, the joint of the elbow being in that ſtate ſuffered to yield to the weight of the body, or to bend ſometimes ſlowly and ſometimes faſt; for if at the ſame time we feel with the other hand the flexor and extenſor muſcles of the fore arm, the firſt will be found perfectly relaxed, the latter very much contracted. Thus it is evident that ſome muſcles may be relaxed to determinate degrees of velocity and ſpace, with the ſame certainty as they can be contracted.

51. This laſt phænomenon gave me room to conclude, that the action of the muſcles in general conſiſts as really in the relaxation of the moving fibres when contracted, as in the contraction of them when relaxed, whether this action be performed ſucceſſively or inſtantaneouſly; and it was for this reaſon that when I began to ſpeak of the action of the muſcles, I did not ſay abſolutely that it conſiſted in the contraction of the fleſhy portion, but only that it was principally owing thereto. I do not here ſpeak of thoſe motions that are out of our power, and which we can determine only in part, as thoſe of reſpiration, or not at all, as that of the heart.

52. The particular mechaniſm, or immediate cauſe of muſcular action has very much tortured the brains of many philoſophers. The extreme delicacy of the texture of a moving fibre, and a great number of phænomena, ſome of them very obvious, which have not been attended to, have hitherto prevented the diſcovery of this myſtery. Several hypotheſes have been formed concerning the ſtructure of this fibre, which, as already ſaid, has been ſuppoſed ſpungy, vaſcular, veſicular, contorted, elaſtic, *&c.* and concerning the concurrence of different fluids with the ſuppoſed ſtructure of the fibre; and ſyſtems have even been founded wholly on the ſpring or elaſticity of the ſolid parts of which a muſcle is compoſed.

53. But by conſidering attentively the phænomena already mentioned, eſpecially the firſt three concerning the velocity, ſpace, and duration of muſcular action, all theſe ſyſtems may be deſtroyed. For hitherto no inſtance can be found either in natural effects or in thoſe of art, of any exploſion, fermentation, ebullition, injection, inflation, imbibition, vibration, elaſticity, *&c.* by which we can regulate and determine to a given degree, the ſpace, velocity, and duration of any artificial motion, or by which we can begin and put an end to ſuch motion in an inſtant of time at our pleaſure. It is therefore altogether to no purpoſe to amuſe ourſelves with what has been ſaid on this ſubject: another method muſt be followed, which conſiſts in collecting and examining all the phænomena that can fall under our obſervation.

54. Till ſome ſuch lucky diſcovery is made, what can hi-

therto with the greateſt certainty be gathered from the ſtructure, conformation, and action of the muſcles, is, that their ſtrength depends on the number of their fleſhy fibres, and the extent of their action on the length of theſe fibres.

55. For where-ever ſtrength is more neceſſary than large degrees of motion, there we find the fibres of muſcles proportionably increaſed in number, and that their ſituation in a narrow compaſs is artfully provided for by the oblique diſpoſition of them already mentioned. In like manner, where-ever there is more occaſion for a large degree of motion than for ſtrength, the fleſhy fibres are of a proportionable length. In a word, the ſtrength of a muſcle is as the number of its fleſhy fibres, and the extent of its motion as the length of theſe fibres.

56. To underſtand the uſes and contrivance of each muſcle in particular, we muſt conſider attentively its place or ſituation in general, its external conformation, inſertions, particular ſituation, direction, lateral connection, relation, and compoſition of its parts. We ought likewiſe to examine how the neighbouring muſcles are diſpoſed for producing ſimple motions, and how thoſe that are at a greater diſtance can produce combined or compound motions.

57. It ought moreover to be obſerved, that in ſome ſubjects the muſcles vary, ſome being wanting, and others added in different manners, ſo that we ought to regulate ourſelves by what happens moſt frequently and univerſally, that we may not render the common caſes obſcure for the ſake of a few that are extraordinary, and which ought to be conſidered in the ſame light as we do the inſtances of ſix fingers, eleven ribs, and other varieties of the like kind.

58. Muſcles fixed only to bones act as ſo many powers applied to levers. By a lever we underſtand a long inflexible body, like a rod or bar, by the help of which we raiſe weights and overcome reſiſtances, which it would be more difficult or impoſſible to do with the hands alone.

59. A lever, in order to act, is applied to three different things, at three different places of its length, *viz.* at one place to the weight or reſiſting body, at a ſecond to the power by which it acts, and at a third to a fulcrum, which, with reſpect to the other two, ought to be immoveable; ſo that the whole length of the lever is as it were divided by three

points,

points, which may be termed *the fixed point, point of reſiſtance*, and *point of power.*

60. Theſe three points may be diſpoſed in three different manners. 1. The fixed point may lie between the power and the weight; as when the ſtone-cutters and pavers raiſe or move ſtones with iron crows. 2. The weight may lie between the power and the fulcrum, as when maſons move large ſtones by applying crows to them ſome where near their middle. 3. The power may lie between the weight and fulcrum, as when braſiers ſcrape copper in order to tin it, by laying one end of the ſcraper on their ſhoulder, the other on the metal, and holding the middle in their hands.

61. From theſe three diſpoſitions three different kinds of levers have been eſtabliſhed. In the firſt the fulcrum or fixed point is in the middle; in the ſecond the weight, and in the third the power.

62. In the action of levers the following maxims are to be obſerved as ſo many general rules.

63. The greater the diſtance of the line of direction of the power from the fulcrum, leſs force is neceſſary to overcome the reſiſtance.

64. The nearer that this line of direction is to the fulcrum, more force is neceſſary to overcome the reſiſtance or to raiſe the weight.

65. When the line of direction of the power paſſes through the fixed point, and conſequently falls in with the direction of the lever, the power can produce no effect.

ART. II.

The Muſcles of the Abdomen.

Number and ſituation in general.

66. BY the muſcles of the abdomen or lower belly we mean thoſe which form principally the ſides or circumference of that cavity. They are commonly ten in number, five on each ſide; eight whereof are very large, the other two very ſmall.

Diviſion, figure.

67. Of theſe muſcles two are long, called *muſculi recti*, two ſmall, called *pyramidales*; ſix broad, two of which are named *obliqui externi*, two *obliqui interni*, and two *tranſverſales*. The pyramidales are wanting

ing in ſome ſubjects, ſometimes there is but one, and ſometimes three. The name of theſe two muſcles has been taken from their figure, thoſe of the other eight, from the principal direction of their fibres.

68. Theſe ten muſcles lie in pairs, and thoſe of each ſide appear to be ſeparated by a kind of tendinous line or band running along the anterior part of the abdomen, from the cartilago enſiformis to the ſymphyſis of the Oſſa Pubis, and including the umbilicus; above which it is pretty broad, but narrower below, eſpecially near the Oſſa Pubis.

Linea alba.

69. This tendinous band is named *linea alba*, and, as we ſhall ſee afterwards, is wholly formed by the intertexture of the tendons of the ſix broad muſcles.

70. I ſhall here deſcribe only the five muſcles of one ſide, the other five being exactly like theſe; and the ſame method will be obſerved through the whole of this treatiſe.

§ 1. *Obliquus Externus.*

Figure and ſituation in general.

71. The obliquus externus is a broad thin muſcle, fleſhy on its upper and back part, and tendinous on the anterior and greateſt portion of the lower part. It reaches from half the lateral and inferior part of the thorax, to almoſt half the lateral and ſuperior part of the pelvis; and from the back part of the regio lumbaris to the linea alba.

Inſertions.

72. It is fixed by its upper part, to the ribs, by the lower, to the Os Ilium, ligamentum Falloppii, and Os Pubis, and by the fore part to the linea alba. The poſterior portion next the vertebræ of the loins has commonly no true muſcular inſertions.

73. In the firſt place, it is fixed to eight ribs (ſeldom to nine), that is, from the fifth true rib to the laſt of the falſe, by the ſame number of angles of its fleſhy portion in the following manner. It adheres to the external labia of the lower edges of the two or three laſt true ribs, and of the four following falſe ribs, at their bony extremities; to the extremity of the cartilage of the laſt falſe rib; to the external labium of the lower edge of that rib, and a little to the broad ligament which connects it to the tranſverſe apophyſis of the firſt vertebræ of the loins.

74. The

74. The inſertions in the bony extremities of the ribs are at different diſtances from the cartilages in this order: in the ſeventh true rib the inſertion is very near the cartilage, in the ſixth at a little more diſtance; in the fifth the diſtance is about an inch; in the firſt falſe rib, two inches; in the ſecond and third three inches; in the fourth, about two inches, and ſometimes leſs; in the fifth the inſertion reaches, and in a manner ſurrounds the cartilage.

75. The name of *digitations* or *indentations* has been given to theſe angular inſertions, becauſe they join a like number of the ſame kind belonging to other muſcles, as the fingers of the two hands are locked between each other. Three or four of theſe digitations belong to the ſerratus major; and the ſame number to the latiſſimus dorſi. The three or four loweſt digitations join likewiſe thoſe of the ſerratus poſtericus inferior, which are covered by the extremities of the latiſſimus dorſi.

76. Though theſe digitations appear to be wholly fleſhy, they are almoſt all a little tendinous towards the back part. They ſeem to increaſe in breadth as they deſcend, and often unite more or leſs with the intercoſtal muſcles in their paſſage over them. Sometimes they communicate likewiſe with the pectoral muſcle, the ſerratus major and latiſſimus dorſi, by diſtinct faſciculi of fleſhy fibres, which are true reciprocal continuations of theſe muſcles.

77. There are likewiſe other internal inſertions covered and hid by thoſe which appear outwardly, and which belong to the ribs lying immediately below thoſe to which the outward digitations are fixed. Thus the digitation fixed in the laſt true rib ſends off a faſciculus to the firſt falſe rib, as it runs up on the foreſide thereof.

78. The firſt digitation, or that belonging to the fifth true rib, appears longer than the reſt, and is about the breadth of two fingers, having communicating fibres with the pectoralis major. The ſecond, or that of the ſixth true rib, is about an inch in breadth, and unites a little with one digitation of the ſerratus major. The third, or that of the ſeventh true rib, is about three fingers in breadth, and runs for a ſmall ſpace toward the cartilage on the outſide of the rib. The fourth, or that of the firſt falſe rib, mixes by ſome of its anterior fibres with thoſe of the ſerratus major. The fifth, or that of the

ſecond falſe rib, mixes both with the foregoing and with the firſt digitation of the latiſſimus dorſi, and runs for ſome ſpace on the ſurface of the rib. The ſixth, or that of the third falſe rib, is about two fingers in breadth, and ſends off a faſciculus of fibres to the ſerratus major. The ſeventh is of the ſame breadth with the former, and ſome of its fibres are continued to the ſerratus poſtericus inferior. The eighth, or that belonging to the loweſt falſe rib, has been already deſcribed.

79. From theſe inſertions in the ribs, the fibres of this muſcle run down obliquely from behind forward. Thoſe which come from the three loweſt ribs are leſs oblique than the reſt, appearing to form a diſtinct portion which continues fleſhy all the way to the external labium of the criſta Oſſis Ilium, in which it is inſerted from the poſterior part of the tuberoſity of that criſta, to the anterior and ſuperior ſpine. This inſertion is by very ſhort tendinous fibres through one half of the criſta; through the other half they are longer, and ſome of them communicate with the faſcia lata of the thigh. The poſterior part of this portion ſeems to me to conſiſt of a double plane.

80. The other portion of this muſcle, though not altogether ſeparated from the former, runs more obliquely; and, after ſome ſpace, its fleſhy fibres degenerate into a ſtrong broad aponeuroſis or thin tendon; the extremities of the fleſhy fibres from the fifth true rib to the anterior ſpine of the Os Ilium, forming a line, which till it reaches as low as the umbilicus, is ſtraight, and from thence downward, is incurvated backward. One portion of the tendinous plane runs down to the anterior and ſuperior ſpine of the Os Ilium, where it unites a little with the ſuperior tendon of the muſculus ſartorius, and afterwards is continued to the ſpine of the Os Pubis, being by its lower edge firmly united to the ligamentum Falloppii, and adhering cloſely to the faſcia lata.

81. This aponeuroſis grows firmer and thicker in its progreſs toward the Os Pubis, and in old age becomes hard and dry; for which reaſon hernia's are moſt troubleſome in old people. A little before it reaches the Os Pubis, it is divided into two portions, one ſuperior or anterior, the other inferior or poſterior, between which a fiſſure or opening is left of a particular kind.

82. The ſuperior or anterior portion runs obliquely downward toward the ſpine of the Os Pubis, croſſes over the foreſide of the ſymphyſis, and is inſerted in the lower broad part of the Os Pubis on the other ſide. As it paſſes the ſymphyſis, it croſſes the like portion of the other external oblique, and their fibres decuſſate each other.

83. The inferior or poſterior portion running more downward ends in the middle part of the ſymphyſis, ſome ſmall part of it being continued to the Os Pubis on the other ſide.

84. Near their extremities theſe two portions approach, ſo that the opening formed by them is in ſome meaſure oval, but narrower below than above. Through this opening the ſpermatic veſſels paſs in men, and the round ligaments in women, but in them the opening is much lower than in males. It is about two fingers breadth in length, and about half a finger in breadth at its upper part; and there it is ſtrengthened by ſeveral tendinous fibres detached obliquely from each ſide, which form a ſort of roundiſh border, from whence theſe openings got the name of *rings*. Theſe collateral fibres hardly appear in children.

85. The inferior or poſterior portion ſends off a particular expanſion to the faſcia lata, which having formed a covering for the inguinal glands, is afterwards loſt in the fat.

86. The remaining part of the tendon of the external oblique is fixed by oblique fibres in the linea alba through its whole length, mixing with thoſe that come from the ſame muſcle on the other ſide. Theſe tendinous fibres are likewiſe continued a great way beyond the linea alba through the tendon of the other muſcle, and this intertexture is reciprocal. Thoſe who look upon the fleſhy part of this muſcle as its beginning, call it *obliquus deſcendens*, and it has likewiſe been named *obliquus ſuperior* and *obliquus major*.

§ 2. *Obliquus Internus.*

Figure and ſituation in general.

87. The internal oblique is a broad thin muſcle like the former, having nearly the ſame extent and inſertions, that is, in the lower ribs above; in the criſta of the Os Ilium, and ligamentum Falloppii, below; and in the linea alba, before: but it dif-

fers from it in this, that its lower part is more fleſhy than the upper.

88. One portion of its lower extremity, which is entirely fleſhy, is fixed by very ſhort tendinous fibres in the middle ſpace between the two labia of the criſta Oſſis Ilium, from the back part of the tuberoſity of that criſta near the ſymphyſis of the Os Sacrum, almoſt all the way to the ſuperior and anterior ſpine of the Os Ilium; ſo that its inſertion reaches further back than that of the external oblique.

Inſertions.

89. The fleſhy fibres thus fixed, run up firſt a little obliquely from behind forward, and then this obliquity increaſes proportionably as the fibres lie more anteriorly, and they croſs thoſe of the fleſhy portion of the external obliquely, being afterwards inſerted exteriorly in the lower edges of the cartilages of all the falſe ribs, and thoſe of the two loweſt true ribs, reaching to the extremity of the cartilago enſiformis.

90. Theſe inſertions form fleſhy digitations at the extremity of the loweſt falſe rib, at the bony extremity of the fourth, and through all its cartilage, and at the middle portion of the cartilage of the third. Here the inſertions become tendinous, and an aponeuroſis is formed, which from the ſecond falſe rib anteriorly, is divided into two laminæ by which the muſculus rectus is incloſed.

91. The other portion of the lower extremity of this muſcle, continuous with the former, is fixed to the anterior extremity of the criſta of the Os Ilium, to its anterior and ſuperior ſpine, and to that part of the ligamentum Falloppii which lies neareſt it. From all this inſertion, the fibres expand like radii through the whole extent of the linea alba. Thoſe from the criſta run toward the upper part of the linea alba, and afterwards they gradually change their direction, till at length they become almoſt perpendicular to that line. Thoſe that come from the ſpine and ligamentum Falloppii, are gradually bent downward, and are inſerted partly in the ſpine, partly in the ſymphyſis of the Os Pubis, being inſeparably mixed with the lower edge of the aponeuroſis of the external oblique.

92. This anterior or radiated portion being at its beginning wholly fleſhy, becomes afterwards wholly tendinous, and, together with the tendon of the other portion, forms

an aponeuroſis like that of the external oblique, the extremeties of all the fleſhy fibres forming an oblique line a little bent from above downward, beginning at the third falſe rib. and reaching to the ligamentum Falloppii.

93. The aponeuroſis of the internal oblique thus formed, is afterwards divided into two laminæ, from the extremity of the ſecond falſe rib, to its lower edge; and having by this diviſion furniſhed a vagina to the muſculus rectus and pyramidalis of the ſame ſide, the two laminæ unite again at the linea alba, being interwoven with thoſe belonging to the muſcle on the other ſide, and mixed with the aponeuroſis of the external oblique in a very ſingular manner. This aponeuroſis is every where cloſely joined to that of the external oblique, and the vaginæ of the rectus ſeems to be ſtronger above the umbilicus than below it, and near the lower extremity of the linea alba becomes ſo thin, that the rectus and pyramidalis may be ſeen through it.

94. In the paſſage between the anterior and ſuperior ſpine of the Os Ilium, and Os Pubis, at ſome diſtance above and behind the tendinous opening or ring of the external oblique, the fleſhy fibres at the lower edge of the internal oblique, leave a paſſage for the ſpermatic veſſels in men, and for the vaſcular rope called the *round ligaments* in women. This paſſage is near the place where this muſcle joins the aponeuroſis of the former; and though it appears in ſome ſubjects to be formed by a real ſeparation of ſome fleſhy fibres, in others it lies between the fleſhy edge of this muſcle and the inſertion of the obliquus externus in the ligamentum Falloppii. In this courſe a faſciculus of fleſhy fibres is likewiſe detached from this muſcle, which contributes to the formation of a ſmall muſcle called *cremaſter*, as we ſhall afterwards ſee.

95. There is moreover a thin plane or ſeries of fleſhy fibres, between the back part of this muſcle and the aponeuroſis of the muſculus tranſverſalis, which covers the quadratus lumborum, and ſeems to be fixed by a broad aponeuroſis to the ligament which goes between the laſt vertebra of the loins and the tubercle of the criſta Oſſis Ilium From thence it runs obliquely upward and forward, and contracting in breadth is fixed in the extremity of the laſt falſe rib. Therefore if this ſeries be reckoned a part of the internal oblique, this muſcle muſt be ſaid to be inſerted not only in the criſta of the Os

Ilium, but alſo in the laſt vertebra of the loins, by means of the ligament already mentioned.

96. This muſcle is likewiſe called *obliquus deſcendens*, for the ſame reaſon that the former is termed *aſcendens*, *obliquus inferior* and *obliquus minor*, becauſe it does not reach ſo high, and is not quite ſo large as the external oblique.

§ 3. *Muſculi Recti.*

97. The recti are long narrow muſcles, thicker than the obliquii. They lie near each other like two large bands, from the lower part of the Thorax to the Os Pubis, the linea alba coming between them. Their breadth diminiſhes, and their thickneſs increaſes gradually from above downward.

Figure and ſituation in general.

98. The ſuperior extremity of each muſcle is fixed to a part of the lower extremity of the ſternum, to the three loweſt true ribs, and to the firſt falſe rib, by the ſame number of digitations, of which that which is furtheſt from the ſternum is the broadeſt.

Inſertions.

99. The body of the muſcle lies in the vagina, formed by the aponeuroſis of the broad muſcles of the abdomen. Exteriorly it is divided into ſeveral portions reſembling diſtinct muſcles placed endwiſe, by tranſverſe tendons termed *enervations*, which commonly are all above the umbilicus, very ſeldom below it, and they adhere very cloſe to the vagina.

100. Theſe interſections are pretty irregular They do not always penetrate the whole thickneſs of the muſcle, and in that caſe they do not at all appear, or but very little, on the inner ſurface. Sometimes thoſe which are ſeen on the outer ſurface do not run quite croſs the whole breadth of the muſcle.

101. The lower extremity of this muſcle is narrower than the upper, and ends in a thin tendon fixed in the internal labium of the upper edge of the Os Pubis near the ſymphyſis, and there it touches the tendon of the other rectus.

102. Above the umbilicus theſe two muſcles are at ſome diſtance from each other, according to the breadth of the linea alba; but below it they come nearer, the linea alba being there narrower, and near their lower extremity that line is almoſt entirely hid by their thick edges.

§ 4. *Muſculi Pyramidales.*

103. At the lower part of the recti we meet commonly with two ſmall muſcles, which at firſt ſight ſeem to be a portion or appendix of the former. They are named *pyramidales* from their figure, and by Falloppius, *ſuccenturiati.*

Situation in general, and figure.

104. At the lower extremity they are broad and thick, being there fixed to the upper edge of the Oſſa Pubis, immediately before the recti. They decreaſe gradually in breadth and thickneſs as they aſcend, and end by a point in the linea alba, a little way below the umbilicus.

Inſertions.

105. They are partly incloſed within the vagina of the recti, running cloſe by each other along the linea alba, to which they are fixed at different diſtances by oblique tendinous indentations, the uppermoſt of which are ſometimes very long.

106. Sometimes theſe muſcles are wanting, and then the lower extremities of the recti are thicker than uſual. Sometimes there is only one pyramidalis; and ſometimes they are not both of the ſame ſize and length. We very rarely meet with three in one ſubject.

§ 5. *Tranſverſales.*

107. The tranſverſe muſcles are nearly of the ſame breadth with the obliques. Their name is taken from the direction of their fibres, and each of them is fixed to the ribs, above; below, to the Os Ilium and ligamentum Falloppii; before, to the linea alba; and behind, to the vertebræ.

Figure and ſituation in general.

108. The upper part of this muſcle is fixed to the lower part of the inner ſurface of the cartilages of the two loweſt true ribs, and of all the five falſe ribs, by fleſhy digitations, the fibres of which run more or leſs tranſverſely toward the linea alba, at ſome diſtance from which they become tendinous. Theſe digitations meet, and exactly correſpond with thoſe of the diaphragm, but never mix with them in the human body.

109. The middle part is fixed to the three firſt vertebræ

of the loins, by a double aponeuroſis or two tendinous planes, one internal or anterior, the other external or poſterior. The internal is inſerted in the tranſverſe apophyſes, the external in the ſpinal apophyſes and interſpinal ligaments, being cloſely united to the tendinous expanſions of the neighbouring muſcles; and the external planes of both tranſverſales appear to be continuous, their common inſertion in the ſpinal apophyſes by no means hindering them from ſliding, like a girth, towards either ſide on the proceſſes juſt mentioned.

110. The internal and external planes having incloſed in their duplicature, the muſculus ſacra lumbaris and quadratus lumborum, unite in one ſtrong aponeuroſis at the edges of theſe muſcles. From this aponeuroſis ariſes the middle and greateſt part of the fleſhy portion of the tranſverſalis, which, together with the ſuperior part, advances towards the linea alba, and at ſome diſtance from it becomes tendinous.

111. The inferior part of this muſcle is fixed by an inſertion wholly fleſhy to the internal labium of the criſta Oſſis Ilium, and to a great part of the ligamentum Falloppii. From thence many of its fibres run towards the linea alba, the reſt to the Os Pubis, all of them becoming more or leſs tendinous before their inſertion.

112. It is commonly ſaid that there is a ſeparation in the fleſhy fibres of this portion behind that ſuppoſed to be in the internal oblique, for the paſſage of the ſpermatic veſſels, *&c.* There is indeed a ſort of opening, but it is ſo very near the internal oblique, as to make it very doubtful at firſt ſight, whether it be formed by a ſeparation of the fibres of the tranſverſalis, or lies between the fleſhy edges of that muſcle and of the obliquus internus which after a careful examination appears to be the caſe.

113. This proximity makes it no eaſy matter for many anatomiſts to determine whether the fleſhy fibres of which the cremaſter muſcle partly conſiſts, belong entirely to the internal oblique, or whether ſome of them do not likewiſe come from the tranſverſalis, as others do from the ligamentum Falloppii.

114. The middle part of the fleſhy plane of this muſcle ends in a very broad aponeuroſis cloſely adhering to that of the obliquus internus, the vagina or duplicature of which it ſtrengthens interiorly, as that of the outer oblique does exteriorly.

teriorly. Afterwards this aponeuroſis reaches the linea alba, and joins that of the other tranſverſalis by a particular ſort of intertexture, without mixing either with the internal oblique or with the peritoneum. The whole aponeuroſis of the three parts of this muſcle from the fleſhy fibres to the linea alba, repreſents a kind of creſcent, and it was for this reaſon that the ancients have ſaid that it terminated forward in a ſemilunar line.

§ 6. *Connection of the obliqui and tranſverſales.*

115. Theſe three muſcles are not only united by their lower edges, and inſerted together in the ligamentum Falloppii, but alſo braced by the adheſion of the facia lata to that ligament, and by the connection of its ligamentary fibres with the tendon of the external oblique. This place is commonly called the *tendinous arch* of the muſcles of the abdomen, becauſe it appears in this ſhape when the faſcia lata is removed. This connection is ſtrengthened by a very thin expanſion of tendinous filaments, which decuſſate the aponeuroſis of the obliquus externus, and reaching all the way to the fiſſure, ſtrengthen the upper edge thereof in the manner already ſaid.

116. When this tendinous expanſion is ſeparated from the aponeuroſis of the external oblique, in young ſubjects and in women the opening does not any more appear like a ring, but ſimply as a void ſpace left by the ſeparation of the tendinous fibres. This expanſion ſeems to be formed by a continuation partly of the tendinous fibres of the obliquus externus, and partly of thoſe of the faſcia lata.

117. The two oblique muſcles and the tranſverſalis of each ſide, are diſpoſed in a very ſingular manner with relation to their fleſhy and tendinous portions; for the tendons of ſome of them anſwer to the fleſhy parts of the reſt. The external oblique is moſt tendinous in the lower part and moſt fleſhy in the upper. The internal oblique is moſt tendinous in the upper part and moſt fleſhy in the lower. The tranſverſalis is moſt tendinous in the middle, and moſt fleſhy in the upper and lower parts. By this diſpoſition theſe three muſcles compoſe nearly an uniform plane, the fleſhy and tendinous fibres being equally diſtributed through all its parts.

118. It is commonly ſaid that the linea alba is only the

concourſe or place where theſe three pairs of muſcles meet; but if we examine well, we find there an intertexture not eaſy to be unravelled. One portion of the external oblique of one ſide ſeems to be continued with a portion of the internal oblique of the oppoſite ſide, theſe four portions making only two digaſtric muſcles, which croſs each other obliquely. In the ſame manner, the two tranſverſales, by the union of their aponeuroſis form a third digaſtric muſcle; ſo that we have here three broad faſcie or bands very artfully croſſing one another, formed indeed not by the whole muſcles, but only by the middle portions of them.

119. The linea alba is perforated by a ſmall round hole near the middle of its length; the circumference of which is formed by tendinous fibres, twiſted and interwoven together in ſuch a manner, as to produce a regular and perfectly round border. Before birth, this hole tranſmits the funis umbilicalis, and then it is pretty large; but in adults it is very much contracted.

§ 7. *Uſes of the abdominal muſcles.*

120. Of theſe uſes, ſome are common to all the muſcles, others peculiar to each pair, or to each muſcle in particular.

121. The common uſes are to ſuſtain the viſcera of the abdomen, and to counterbalance the perpetual motions of ordinary reſpiration, and thereby gently and continually to act on the viſcera; which action may be reckoned a ſort of trituration, of great importance to the animal œconomy. They compreſs the abdomen in order to clear it of what ought to paſs off by the natural outlets, to relieve the ſtomach by vomiting, from whatever might be hurtful to it; and laſtly to drive out by violent expiration whatever may incommode the organs contained in the thorax.

Common uſes.

122. Theſe two kinds of motion are carefully to be diſtinguiſhed. The firſt is purely mechanical, and in a manner paſſive; the other is arbitrary and really active.

123. In the firſt, the viſcera preſſed by the diaphragm in inſpiration, force theſe muſcles outward on all ſides, overcoming their natural ſpring; but the diaphragm being relaxed in expiration, and yielding to the viſcera, they recover themſelves again. In the ſecond, theſe muſcles really act,

that is, their fleſhy fibres are contracted and ſhortened, and thereby they compreſs the viſcera, eſpecially the ſtomach and inteſtines, forcing out by the neareſt paſſages whatever is capable of expulſion.

124. In this latter caſe the diaphragm acts while the abdominal muſcles are in contraction, and thereby concurs in an univerſal compreſſion of the belly; but in the firſt caſe it does not act, as ſhall be fully ſhewn hereafter.

125. The particular diſpoſition of the fleſhy and tendinous portions of the obliqui and tranſverſales, renders this compreſſion uniform, and thereby the muſcles reſiſt the force of the compreſſed viſcera, almoſt equally on all ſides.

Proper uſes.

126. The muſculi recti ſerve to ſupport the trunk of the body when inclined backward, and to bend or bring it forward again; to raiſe the body up when lying; and laſtly, to climb. They ſerve, I ſay, to bend the trunk when inclined backward or laid down; for when we ſtand ſtraight, they have no hand in bending the body forward, except we be ſtriving to overcome ſome reſiſtance. The weight of the thorax, head, and ſuperior extremities, joined to the determinate relaxation of the poſterior muſcles of the back and loins, produce this effect in all other caſes, as has been already mentioned in the general obſervations on the action of the muſcles.

127. I am not as yet convinced that the recti can contribute any thing to the arbitrary compreſſion of the abdomen, which has been already mentioned as one common uſe of all theſe muſcles.

128. The pyramidales ſeem only to aſſiſt the action of the recti; though when we conſider the oblique direction of their fibres toward the linea alba, there may be ſome reaſon to think that they compaſs the bladder, eſpecially when very full of urine, as Falloppius has remarked. The lower portions of the internal obliques and tranſverſales may perhaps contribute ſomething to this effect; for when contracted, they form a flat tight kind of girth, by the middle of which the ſuperior extremities of the pyramidales are kept immoveable, while their bodies, being ſhortened and flattened by contracting, preſs upon the bladder.

129. The oblique muſcles are capable of acting by diſtinct portions. Their poſterior portions have nearly the ſame uſes

on each ſide as the recti have before; that is, they ſerve to ſupport the trunk on one ſide when it is inclined to the other; to bend the body to that ſide on which they lie, and to raiſe one ſide of the pelvis or one hip, while the other is well ſupported.

130. The ſuperior and anterior portions of the external oblique of one ſide, together with the inferior portions of the internal oblique of the other ſide, ſerve to turn the thorax upon the pelvis as upon a pivot, the pelvis remaining fixed and immoveable by ſitting. This motion may be termed *the rotation of the thorax on the pelvis.*

131. When we ſtand and turn the thorax to each ſide in the ſame manner, this motion is not at firſt the rotation already mentioned; for the feet remaining then fixed, the legs and thighs turn to one ſide, and carry the pelvis along with them; but this motion being carried as far as is poſſible, and the pelvis being conſequently in a manner fixed, the rotation of the thorax then takes place, by means of the two oppoſite oblique muſcles, in the manner already ſaid.

132. When all the portions of theſe four muſcles act together, they may aſſiſt the recti in great efforts; as for inſtance, when with the arm or breaſt we puſh forward a very heavy body, or drag it after us.

133. The tranſverſales ſeem to have no other uſe than that of bracing or girding the abdomen in different degrees; and this they may do either by their whole plane, or by different portions thereof, and theſe again may gradually ſucceed each other. For inſtance, the ſuperior portion may contract ſeparately, while the inferior portion is totally relaxed, as I have often obſerved in myſelf.

134. There are ſtill other uſes belonging to theſe muſcles, but they cannot be intelligibly explained till ſeveral other muſcles have been deſcribed.

ART. III.

The muſcles which move the bones of the ſhoulder upon the trunk.

135. OF theſe muſcles, ſome are inſerted in the bones of the ſhoulder, others move theſe bones on the trunk without being fixed in them.

136. The muſcles which move the ſcapula and clavicula on the trunk by being inſerted in them are commonly the ſix following.

1. *Trapezius.*	4. *Pectoralis Minor.*
2. *Rhomboides.*	5. *Serratus Major.*
3. *Angularis*, called commonly *Levator Scapulæ proprius.*	6. *Subclavius.*

137. The muſcles, which, without being inſerted in the ſcapula and clavicula, move them upon the trunk, and which therefore may be reckoned aſſiſtants to the former, are two in number, both belonging to that claſs of muſcles by which the Os Humeri is moved on the ſcapula, *viz.*

1. *Pectoralis Major.* 2. *Latiſſimus Dorſi.*

138. The ſcapula in particular, beſides its motion upon the trunk, may alſo be moved upon the Os Humeri, by means of ſome of the muſcles which move the Os Humeri on the ſcapula, as we ſhall ſee hereafter.

139. In each claſs of theſe muſcles I ſhall only deſcribe thoſe which are actually inſerted in the bones belonging to it, leaving to another claſs the muſcles which move thoſe bones without being fixed to them. I ſhall in this place, for inſtance, explain only the ſix muſcles firſt named, and refer the other two to the muſcles which move the Os Humeri on the ſcapula.

§ 1. *Trapezius.*

Situation in general and figure.

140. The trapezius is a large, broad, thin, fleſhy plane, ſituated between the occiput and lower part of the back, and from thence extending to the ſhoulder in the figure of a large irregu-

lar ſquare. From this figure the ancient Greeks took its name; and, together with the trapezius of the other ſide, it forms a kind of lozenge.

141. Above it is fixed in the ſuperior tranſverſe line of the Os Occipitis, by a thin ſeries of fleſhy fibres, reaching to the muſculus occipitalis, and appearing to cover that muſcle by a kind of aponeuroſis. Behind, it is fixed to the five ſuperior ſpinal apophyſes of the neck, by means of the poſterior cervical ligament, aud immediately to the extremities of the two loweſt ſpinal apophyſes of the neck, and of all thoſe of the back.

Inſertions,

142. Theſe inſertions are by ſmall and very ſhort tendinous fibres, except between the ſixth apophyſis of the neck, and the third of the back incluſively, where theſe fibres are ſomething longer, and form a ſmall aponeuroſis in form of a creſcent, which, with that on the other ſide, repreſents a kind of ellipſis pointed at both ends. At the lower ſpinal apophyſis of the back, theſe inſertions are likewiſe tendinous, and form a ſmall triangular plane, which, together with that of the other ſide, repreſents a ſquare.

143. From all theſe inſertions, the fleſhy fibres run in different directions, and terminate by one continued inſertion in about one third part of the clavicula, in the poſterior edge of the acromium, and through the whole ſuperior labium of the ſpine of the ſcapula all the way to the ſmall triangular ſurface in that ſpine, over which ſurface the fibres paſs and ſlide freely, without being fixed therein.

144. The directions of all theſe fibres are theſe: the ſuperior run obliquely downward from the occiput to the clavicula: the next to theſe run a little leſs obliquely, and together with ſome of the ſuperior are fixed in the ſuperior articular ligaments of the ſhoulder, and in the acromium. Here the muſcle forms a kind of angle included in that formed by the acromium and extremity of the clavicle.

145. The reſt of the fibres that come from the neck and thoſe from the ſuperior ſpines of the back, are fixed in the ſpine of the ſcapula, reaching within an inch of the ſmall triangular ſurface, becoming gradually leſs oblique or more tranſverſe as they deſcend.

146. Laſtly, the fibres which come from all the other ſpinal apophyſes of the back, contract like radii tending toward

a centre, and are inſerted in the extremity of the ſpine of the ſcapula, paſſing over the ſmall triangular ſpace, the ſuperior being more or leſs tranſverſe, and the reſt becoming gradually more and more oblique running from below upward.

147. This muſcle covers immediately the ſpleneus or maſtoidæus ſuperior, part of the complexus major, the angularis, rhomboides, and part of the latiſſimus dorſi. The common inſertion of the two trapezii in the cervical ligament is the reaſon that in pulling either of them toward one ſide of the neck, the other will follow it a little beyond the ſpinal apophyſes.

§ 2. *Rhomboides.*

Situation in general.

148. This muſcle is a thin, broad, and obliquely ſquare fleſhy plane, ſituated between the baſis of the ſcapula and the ſpina dorſi; and it is from its figure that it has been termed *rhomboides.*

Diviſion and inſertions.

149. It may be divided into two portions, one ſuperior, the other inferior, which ſometimes appear ſeparate. The ſuperior portion which ſeems in ſome ſubjects to be made up of two, is fixed by an inſertion wholly fleſhy in the two or three loweſt ſpinal apophyſes of the neck, and partly in the poſterior cervical ligament. The inferior portion is fixed by a tendinous plane in the three or four uppermoſt ſpinal apophyſes of the back.

150. Theſe two portions, of which the inferior is by much the broadeſt, being united, are inſerted in the edge of the baſis ſcapulæ, from the ſmall triangular ſpace to the inferior angle, the ſuperior portion covering a ſmall part of the inſertion of the angularis.

Particular ſituation.

151. This whole muſcle is covered by the trapezius, and covers immediately the ſerratus poſticus ſuperior, being joined to each of theſe muſcles by a filamentary or cellulous ſubſtance.

§ 3. *Angularis, vulgo levator ſcapulæ proprius.*

Situation in general.

152. This is a long and pretty thick muſcle, about two fingers in breadth, lying above the

ſuperior angle of the ſcapula along the poſterior lateral part of the neck of that bone.

153. It is inſerted above in the extremities of the tranſverſe apophyſes of the four firſt vertebræ of the neck, by four fleſhy branches ending in ſhort tendons; ſometimes the ſecond, ſometimes the third, or both, and ſometimes the fourth of theſe branches is wanting; theſe defects being made up by the largeneſs of the reſt.

Inſertions.

154. From thence theſe branches run down a little obliquely, and then uniting together, they are inſerted in the ſuperior angle of the ſcapula, and in the edge of its baſis from thence to the ſmall triangular ſpace, being there covered a little by the rhomboides.

155. This muſcle is eaſily divided into two through its whole length. It is covered by the trapezius, and its inſertions in the neck are ſometimes mixed with thoſe of the neighbouring muſcles.

Particular ſituation.

§ 4. *Pectoralis Minor.*

156. This is a ſmall fleſhy muſcle, ſomething of a triangular ſhape, ſituated at the ſuperior, lateral, and anterior part of the thorax.

Situation in general.

157. By its baſis it is inſerted in the external labium of the upper edge of the ſecond, third, fourth, and fifth true ribs, near their union with the cartilages, by the ſame number of digitations or ſeparate fleſhy portions, becauſe of the intervals between the ribs; and for that reaſon it has been called *ſerratus minor anticus.*

Inſertions.

158. From thence theſe portions run up more or leſs obliquely, toward the ſhoulder, and form a fleſhy belly which contracts as it paſſes before the two firſt ribs, and then becoming a ſhort, flat, and broad tendon, is inſerted in the upper part of the apophyſis coracoides of the ſcapula, reaching all the way to the point of that proceſs.

159. This muſcle is covered by the pectoralis major, and adheres very cloſely to the external intercoſtal muſcles. The digitations commonly taken notice of, cover and hide ſeveral others, by which the number of fibres and thickneſs of this muſcle are increaſed.

Particular ſituation.

increaſed. Its tendon unites a little at the apex of the coracoide apophyſis, with the inſertion of the coraco-brachialis, and with that of one portion of the biceps.

§ 5. *Serratus Major.*

160. This is a broad, fleſhy, and pretty thick muſcle, lying on the lateral part of the thorax between the ribs and ſcapula by which it is covered. Its figure is that of an irregular ſquare, its greateſt breadth being in the back part where it terminates by digitations of unequal lengths, in a radicated diſpoſition, their extremities deſcribing an arch or curve; and from theſe digitations its name is taken.

Situation in general.

161. It is inſerted backward in the internal labium of all the baſis of the ſcapula from the ſuperior to the inferior angle. From thence running forward wholly fleſhy, it increaſes gradually in breadth, and is inſerted in all the true ribs, and often in one or two of the falſe ribs, by the ſame number of digitations.

Inſertions.

162. The inſertion in the firſt true rib is about five fingers breadth from the cartilage; in the ſecond, ſomething leſs; in the third, about four fingers breadth; in the fourth, three; in the fifth, two; in the ſixth, one; in the ſeventh, one half; and in the firſt falſe rib, two fingers breadth; but in all theſe meaſures ſome latitude is to be allowed. The breadth of each inſertion in the ribs is at leaſt an inch.

163. Though the digitations of this muſcle give it a radiated appearance from the ſcapula to the ribs, yet theſe radii do not at all lie in that diſpoſition which at firſt ſight we would be apt to imagine. The muſcle is made up of two planes, one great, the other ſmall.

Diviſion and particular ſituation.

164. The ſmall plane looks like a diſtinct narrow muſcle, cloſely adhering to the ſuperior edge of the great plane. It is fixed by one extremity under the ſuperior angle of the ſcapula, and by the other to the firſt rib by a ſmall inſertion, and to the ſecond rib by a broad inſertion. This plane is eaſily ſeen by turning the ſcapula forward, having firſt ſeparated the rhomboides; but when that is turned back, the

pectoralis minor being firſt cut off, this plane does not appear, being covered and hid by the broad one.

165. The broad plane may be divided into two portions, one ſuperior and one inferior, adhering to each other by their edges.

166. The ſuperior portion is thin, and takes up about three quarters of the baſis of the ſcapula, reckoning from the ſuperior angle. From thence it contracts by ſmall degrees, and forms two digitations very like thoſe of the ſmall plane, which they cover by their inſertions in the two firſt true ribs, or in the ſecond and third, and ſometimes in all the three.

167. The inferior portion is fixed in the lower quarter of the baſis ſcapulæ, from whence it expands itſelf by ſix or ſeven very long fleſhy digitations, which decreaſe in breadth as they deſcend, and are inſerted, in the manner already ſaid, in the ſix or ſeven ribs which follow the two firſt. It muſt be obſerved, that the three firſt digitations take up almoſt all this quarter of the baſis ſcapulæ, the three laſt being fixed preciſely in the inferior angle. The extremities of the three or four loweſt digitations mix fibres with thoſe of the obliquus externus of the abdomen.

168. The direction of the fibres and digitations of the ſerratus major will be eaſily comprehended, by recollecting that the ribs are inclined downward in different degrees from behind forward; for which reaſon the fibres of the ſuperior portion of the broad plane, croſs over the ribs at leſs acute angles than thoſe below them, ſo that, in the natural ſituation of the ſcapula, the loweſt of theſe fibres which run up very obliquely, croſs over the third, fourth, and fifth true ribs.

169. The upper fibres of the inferior portion of the broad plane, run up proportionably more obliquely, and therefore croſs over more ribs, and at more acute angles than the others which are leſs oblique; and though ſome of them run tranſverſely, yet the ribs being oblique, they muſt croſs over ſome of them, though in a leſſer degree. The loweſt of theſe fibres or digitations run a little downward, and conſequently fall in more with the direction of the ribs, but not ſo much as may be imagined. Theſe digitations are very ſmall and weak.

§ 6. *Sub-*

§ 6. *Subclavius.*

170. This is a ſmall oblong muſcle lying between the clavicle and the firſt rib. It is fixed by one end in all the middle lower portion of the clavicle, at the diſtance of about an inch from each extremity ; and by the other, in the cartilage and a ſmall part of the bone of the firſt rib. It ſeems likewiſe to adhere to the extremity of the clavicle next the ſternum, by a kind of broad thin ligament.

ART. IV.

The muſcles which move the Os Humeri on the ſcapula.

171. THE muſcles which are inſerted in the Os Humeri, and thereby move it upon the ſcapula, are commonly nine in number, *viz.*

1. *Pectoralis Major.*
2. *Latiſſimus Dorſi.*
3. *Deltoides.*
4. *Supra-ſpinatus.*
5. *Infra-ſpinatus.*
6. *Teres Major.*
7. *Teres Minor.*
8. *Subſcapularis.*
9. *Coraco-Brachialis.*

172. The pectoralis major is inſerted in the trunk and clavicula ; the latiſſimus dorſi in the trunk and ſcapula ; the deltoides in the two bones of the ſhoulder ; and the other ſix muſcles in the ſcapula alone.

173. Two of theſe nine muſcles may likewiſe move the bones of the ſhoulder on the trunk ; the other ſeven may move the ſcapula on the Os Humeri.

174. The muſcles which without being inſerted in the Os Humeri, may in ſome circumſtances move it upon the ſcapula, are two in number, belonging to the claſs of muſcles which move the bones of the fore-arm on the Os Humeri, *viz.*

10. *Biceps.*
11. *Anconæus major*, commonly called *extenſor cubiti major.*

Both theſe muſcles may likewiſe move the ſcapula on the Os Humeri, as ſhall be remarked in deſcribing them.

§ 1. *Deltoides.*

175. This is a very thick muſcle covering the upper part of the arm and forming what is termed the ſtump of the ſhoulder. It is broad above and narrow below in a triangular form; and its name is taken from the reſemblance it bears to the Greek letter Δ Delta; but to make the compariſon hold, either the letter or the muſcle muſt be inverted, and the muſcle flattened.

Situation in general and figure.

176. It is made up of eighteen or twenty ſmall ſingle muſcles in an oppoſite ſituation with reſpect to each other, and united by middle tendons, ſo that taken all together they form ſeveral penniform muſcles. The outer ſurface appears almoſt wholly fleſhy, but on the inner ſurface we ſee the ſeveral tendons.

Structure.

177. All theſe ſmall muſcles are diſpoſed in ſuch a manner as to form a conſiderable extent at the upper part, from whence they contract gradually in breadth, till they end in a thick ſtrong tendon, by which the whole muſcle terminates in an angle or point.

178. Above, it is fixed in the whole inferior labium of the ſpina ſcapulæ, in the convex or long edge of the acromium, and in the third part of the anterior edge of the clavicle next that apophyſes. It ſurrounds the angle formed by the articulation of theſe two bones by a particular ſlope and fold contrived for that purpoſe.

Inſertions.

179. From thence it runs down above one third of the length of the Os Humeri, where it is inſerted by a thick tendon in the large muſcular rough impreſſion below the bony ridge which goes from the great tuberoſity of the head of the bone, and forms the higheſt border of the groove or channel mentioned in the deſcription of the ſkeleton, N° 638.

180. This inſertion ſeems to be immediately implanted in the ſubſtance of the bone, paſſing through the perioſteum, which is commonly the caſe in all inſertions in theſe kinds of impreſſions, eminencies, or conſiderable tuberoſities. It lies below that of the pectoralis major, and a little more forward. Some of the fibres of this muſcles are fixed in the aponeuroſis common to all the muſcles which cover the arm.

181. This muſcle may be diſtinguiſhed into three principal

Diviſion. pal portions, one of which is fixed in the ſpine of the ſcapula, one in the acromium, and one in the clavicle. They are ſeparated from each other by a ſmall quantity of fat or cellular ſubſtance chiefly near the baſis of the muſcle.

182. The middle and ſtrongeſt portion runs down almoſt directly to its inſertion in the Os Humeri. The lateral portions ſeem to end ſooner, but it is only becauſe they turn inward toward the bone, and thereby form the biggeſt and thickeſt part of the tendon. The anterior or clavicular portion ſends off ſome fibres to the bone, before it reaches the tendon.

183. The portion fixed in the ſpine of the ſcapula, ſends backward a thin aponeuroſis, which is ſtrengthened by another tendinous or ligamentary ſeries of fibres. This aponeuroſis is fixed in the baſis of the ſcapula below the ſpine, and from thence is extended toward the inferior angle. The other ſeries begins at the ſpine, and ends near the ſame angle at the beginning of the inferior coſta. Theſe, together with the great tendon, ſeem to contribute to the formation of the tendinous expanſion which covers the muſcles of the arm.

Particular ſituation. 184. At its upper part this muſcle joins the inſertion of the trapezius, and below, that of the brachialis. Anteriorly it joins the pectoralis major, being diſtinguiſhed from it only by a ſmall line of fat or of cellular ſubſtance, and a ſmall vein called *cephalica.* It covers the head of the Os Humeri, and adheres to the capſular ligament of the joint, and it likewiſe covers the inſertion of the pectoralis major.

§ 2. *Pectoralis Major.*

Situation in general and diviſion. 185. This is a large, thick, and fleſhy muſcle, covering the fore-part of the breaſt, from the ſternum where it is very broad, to the axilla where it contracts in its paſſage to the arm. It is naturally divided into two portions, one ſuperior and ſmall, which may be termed *clavicular*; the other inferior and large, which we may call *thoracic.*

186. The clavicular portion is fixed by a fleſhy inſertion in almoſt half the clavicle next the ſternum, ending under the

inſertion of the ſterno maſtoidæus. From thence it runs obliquely down toward the axilla, contracting by ſmall degrees, and ends in a flat tendon or tendinous band. In this paſſage, it borders on the anterior edge of the deltoides, from which it is diſtinguiſhed only by a fatty or cellulous line, and a ſmall vein named *vena cephalica.*

187. The thoracic portion is broad and in ſome meaſure radiated. It is fixed by its anterior circumference in the lateral part of the outſide of the ſternum, in the outſide of the cartilages, and in a ſmall part of the bones of all the true ribs, and of the firſt and ſometimes the ſecond falſe rib. All theſe inſertions are like ſo many digitations.

188. The inſertions in the ſternum end by a great number of very ſhort tendons which run toward the middle of the bone, meeting and decuſſating thoſe from the ſame muſcle on the other ſide. The lower inſertions are moſt diſtinctly digitated, and they mix with thoſe belonging to the rectus and obliquus externus of the abdomen, there being likewiſe ſeveral faſciculi of fibres common to the pectoralis with theſe muſcles. This portion is alſo fixed to the ribs by internal fleſhy ſtrata covered by the external inſertions, and forming, together with them, the thickneſs of the muſcle.

189. From thence all the fleſhy fibres contract in breadth and approach each other, in their paſſage to the arm. The ſuperior fibres run downward, joining thoſe of the clavicular portion; thoſe next them run leſs obliquely; the following more or leſs tranſverſely, and the inferior run upward, in the ſame manner. This whole portion ends at length in a flat tendon joined to that of the ſmall portion, and folded back upon it in the following manner.

190. The inferior fleſhy fibres of the thoracic portion, before they reach the tendon in their paſſage to the arm, are gradually turned inward under each other, and then run up behind the extremities of the ſuperior fibres. By this turn, the lower part of the tendon anſwers to the ſuperior fleſhy fibres, the middle fibres of both to each other, and the upper part of the tendon to the lower fleſhy fibres, and ſo on. Thus the tendons of both portions adhering cloſely by their flat ſides, and united at their edges, form a double tendinous plane, the fibres croſſing each other. The anterior or exter-

nal plane belongs to the clavicular portion; the internal or poſterior plane to the thoracic portion.

191. The tendon thus formed is inſerted, according to its breadth, at about one fourth part of the length of the bone from the head, in the bony ridge of the great tuberoſity, that is, in the outer edge of the groove or channel, the cavity of which it lines in conjunction with another tendon, by a ſtratum of very thin, ſhining, tranſverſe fibres. This inſertion lies between that of the tendon of the deltoides which it touches, and that of the latiſſimus dorſi, which is on the other ſide of the groove.

192. This muſcle, together with the deltoides, ſends off an aponeuroſis, which joining that of the biceps, is ſpread over the muſcles of the arm. It partly covers the pectoralis minor and ſerratus major, and by its broad tendon it covers tranſverſely the brachial channel and the tendon of the biceps lodged there. Laſtly, it forms the anterior border of the hollow of the axilla, as the poſterior is formed by the latiſſimus dorſi.

§ 3. *Latiſſimus Dorſi.*

Situation in general.

193. This is a broad, thin, and moſtly fleſhy muſcle lying between the axilla where it is very narrow, and the back on which it expands itſelf by radiated fibres both in length and breadth, from the middle of the back all the way to the lower part of the regio lumbaris; and from this ſituation it has its name.

Inſertions.

194. Its inſertions, without reckoning that in the arm, are partly tendinous and partly fleſhy. In the firſt place, it is ſometimes, but not always, fixed in the inferior coſta of the ſcapula near the angle by a faſciculus of fleſhy fibres. In the next place, it is fixed by an aponeuroſis, in the ſpinal apophyſes of the ſix or ſeven, and ſometimes eight loweſt vertebræ of the back, in thoſe of all the vertebræ of the loins, in the ſuperior ſpines and lateral parts of the Os Sacrum, and in the external labium of the poſterior part of the Os Ilium.

195. Beſides all this tendinous courſe, it is inſerted by fleſhy digitations in the laſt four falſe ribs. Theſe digitations cover thoſe of the ſerratus inferior poſticus, and mix with

thoſe of the obliquus externus abdominis, there being ſometimes faſciculi of fibres common to both muſcles. It is not always fixed to the loweſt falſe rib; and ſometimes that inſertion is by a particular kind of aponeuroſis which is pretty ſtrong. I have likewiſe ſeen it fixed to the firſt falſe rib by a very ſmall thin digitation.

196. From all theſe inſertions the fibres of this muſcle tend in different directions to the arm. At the middle of the back they are almoſt tranſverſe, and they become more and more oblique as they deſcend. Towards the region of the loins their obliquity decreaſes again, and on the ribs they are almoſt longitudinal. As they run up they contract in breadth, and under the axilla they terminate in a flat tendon, turned almoſt in the ſame manner as that of the pectoralis major, but more ſimply, and without any adheſion between the two planes. The upper edge of this flat tendon is turned inward, anſwering to the lower or lateral part of the muſcle, and the lower edge which hides the other by croſſing a little over it, anſwers to the upper or poſterior part of the muſcle.

197. The tendon thus formed is fixed in the Os Humeri a little below the ſmall ſuperior tuberoſity, in the inner edge of the bony groove or channel, the cavity of which it alſo lines by a tranſverſe ſmooth expanſion, nearly as is done by the tendon of the pectoralis major from the other edge, ſo that theſe two tendons meeting by their extremities in the groove, appear in ſome meaſure to be continued with each other; I ſay, in ſome meaſure, becauſe the tendon of this muſcle is not ſo broad as that of the pectoralis major.

Connection.

198. The tendon of the latiſſimus dorſi is accompanied by another flat tendon belonging to the teres major; but it is inſerted higher up than that other tendon and nearer the channel, ſo that the lower edge of the tendon of the latiſſimus dorſi may be ſaid to encroach on the upper edge of the other tendon. Theſe two tendons communicate by ſome collateral fibres, and are both ſtrengthened by the ſame ligamentary frænum, which runs down from the inſertion of the ſubſcapularis below that of the teres major, in deſcribing which muſcle, I ſhall have occaſion again to mention this frænum.

199. This muſcle is covered by the trapezius, from the

Particular ſituation. ſixth to the laſt vertebra of the back, and covers the ſerratus inferior poſticus. Its aponeuroſis is at firſt narrow, but increaſes in breadth as it deſcends between the vertebræ and Os Ilium. It adheres ſtrongly to that of the ſerratus inferior poſticus, and ſtill more to the tranſverſalis, ſacro-lumbaris, and longiſſimus dorſi. This muſcle, together with the pectoralis major, forms the cavity of the axilla.

§ 3. *Teres Major.*

200. *Situation in general.* This is a long, thick, flat muſcle, ſituated a little obliquely between the inferior angle of the ſcapula, and the upper part of the arm. This muſcle and the teres minor are called *round*, though they are conſiderably broader than they are thick; becauſe they come much nearer to that figure, than any other muſcle which moves the Os Humeri on the ſcapula.

201. *Inſertions.* It is fixed by its poſterior fleſhy extremity in all the large angular ſurface on the outſide of the ſcapula, in the inferior coſta of that bone and near the angle. From thence it advances with longitudinal fibres toward the upper quarter of the Os Humeri, terminating in a broad flat tendon intermixed with ſome fleſhy fibres, which at the upper edge are continued all the way to the inſertion, lying in the ſame place with the tendon.

202. It is inſerted by its anterior extremity at the lower part of the bony ridge of the ſmall tuberoſity, along the edge of the channel, almoſt oppoſite to, and ſometimes a little lower than the inſertion of the pectoralis major. It lines the cavity of the channel by a tendinous elongation, which joins that from the pectoralis, and ſeems to be continued with it. This inſertion is below that of the latiſſimus dorſi, with which it communicates by a ſmall aponeuroſis.

203. The tendons of theſe two muſcles, the teres major and latiſſimus dorſi, lie almoſt in the ſame plane, as has been already obſerved, the upper edge of the firſt running up a little way on one ſide the lower edge of the latter, and the two edges croſſing each other in a ſmall degree. The tendon of the latiſſimus dorſi lies behind, and covers that of the teres major.

204. Theſe two tendons near their inſertions have a ligamentary frænum belonging to them, which runs down from the inſertion of the ſubſcapularis, and is inſerted below that of tqe teres major. It covers the two tendons, and keeps them cloſe to the bone.

§ 5. *Teres Minor.*

205. This is a very fleſhy muſcle, reſembling the teres major, but narrower and ſhorter. It lies above the laſt-named muſcle, between the coſta inferior of the ſcapula and the head of the Os Humeri. *Situation in general.*

206. It is fixed by one end to all the middle part of the inferior coſta of the ſcapula, and to the long particular ſurface immediately above that coſta, reaching from the great angular ſurface near the neck of the bone. From thence it runs wholly fleſhy, till it changes into a flat tendon which is inſerted in the poſterior or inferior ſurface of the great tuberoſity of the head of the bone, and likewiſe a little lower down. *Inſertions.*

207. It adheres very cloſe to the lower edge of the infra-ſpinatus, and the tendons of theſe two muſcles are united; for which reaſon the ancients confounded them together, and did not look upon this as a particular muſcle. It is covered by the deltoides. *Connection.*

§ 6. *Infra-ſpinatus.*

208. This is a triangular, fleſhy, and pretty broad muſcle, in ſome meaſure penniform, filling the whole infra-ſpinal cavity or foſſa of the ſcapula. *Situation in general.*

209. It is fixed in the poſterior half of the infra-ſpinal cavity or foſſa, and to the correſponding part of the baſis of the ſcapula. *Inſertions.*

210. From thence ariſe a great number of ſhort fleſhy fibres, which run more or leſs obliquely, and end in a middle tendinous plane, which terminates a little below the broadeſt part of the ſpine of the ſcapula, under the root of the acromium.

211. Then the fleſhy fibres leaving the bone, unite in one

fleſhy maſs, which paſſing under the acromium over the articulation of the head of the Os Humeri, and adhering to the capſular ligament, terminates there in a flat broad tendon, which adhering likewiſe to the capſula, is afterwards inſerted in the greater middle ſurface of the great tuberoſity of the head of the Os Humeri. At the place where the fibres leave the infra-ſpinal foſſa under the acromium, there is a great quantity of fat or adipoſe cells, between the bone and the looſe portion of the fleſhy maſs.

Connection. 212. This muſcle appears double a little below the ſpine and toward the baſis of the ſcapula, becauſe of the middle tendinous plane already mentioned. It ſeems likewiſe to be confounded with the teres minor, to which it is very cloſely joined. Its tendon is united on one ſide with that of the teres major, and on the other with that of the ſupra-ſpinatus, and it is covered by the poſterior portion of the deltoides.

§ 7. *Supra-ſpinatus.*

Situation in general. 213. This is a thick narrow muſcle, in ſome meaſure penniform, filling all the ſupra-ſpinal cavity of the ſcapula.

214, It is fixed to all the poſterior half of the ſupra-ſpinal foſſa, and ſometimes its inſertion reaches near the neck of the bone. There the fibres leave the ſurface of the bone, and being, as it were, ſupported by the fat or cellulous ſubſtance, paſs between the acromium and neck of the ſcapula, under the arch formed by the acromium and extremity of the clavicle, and under the ligament between the acromium and apophyſis coracoides; being afterwards inſerted in the ſuperior ſurface of the great tuberoſity of the head of the Os Humeri, very near the bony channel. This muſcle is covered by the trapezius.

§ 8. *Coraco-brachialis.*

Situation in general. 215. This is a long muſcle lying on the inſide of the upper half of the Os Humeri, that is, on that ſide which anſwers directly to the hemiſphere of the head of the bone, and to the prominent internal condyle.

216 It is fixed above to the point of the caracoide apophyſis, between the inſertions of the biceps and pectoralis minor, by a tendon, which, as it deſcends, adheres for a good way to the tendons of theſe two muſcles. Afterwards it becomes fleſhy, and is inſerted by a broad thin extremity with a ſmall mixture of tendinous fibres, in the middle part of the Os Humeri, cloſe by the ligamentary frænum of the latiſſimus dorſi and teres major. Its inſertion is continued down below the frænum near the internal intermuſcular ligament, to which it likewiſe adheres a little.

Inſertions.

217. This muſcle paſſes behind the tendon of the pectoralis major; and as it is perforated in the middle to give paſſage to a nerve, it has by ſome been termed *perforatus Caſſerii*, that author being the firſt who gave a particular figure of it. The other name is taken from its inſertions.

Particular ſituation.

§ 9. *Subſcapularis.*

218. This muſcle is of the ſame breadth and length with the ſcapula, of which it occupies all the inner or concave ſide, and from this ſituation it has its name. It is thick, and made up of ſeveral penniform portions nearly in the ſame manner with the deltoides.

Situation in general.

219. It is fixed in the internal labium of the whole baſis, and in almoſt the whole internal ſurface of the ſcapula; its fleſhy portions lying in the intervals between the bony lines, when theſe are found. Near the neck they leave the bone, and form a very broad tendon which is inſerted in the ſurface of the ſmall tuberoſity of the head of the Os Humeri, cloſe by the bony channel. The lower edge of this tendon probably ſends off the ligamentary frænum mentioned in the deſcription of the latiſſimus dorſi, teres major, and coraco-brachialis.

Inſertions.

220. This muſcle covers immediately the ſerratus major, being in a manner incloſed between it and the ſcapula. The upper edge of its tendon is joined to the lower edge of that

of the ſupra-ſpinatus, except at the upper part of the bony channel where they give paſſage to one tendon of the biceps. It likewiſe adheres to the capſular ligament. The tendons of the ſupra-ſpinatus, infra ſpinatus, teres minor, and ſubſcapularis, being all joined by their edges, form a ſort of cap which covers the upper part of the head of the Os Humeri.

ART. V.

The Muſcles which move the bones of the fore-arm on the Os Humeri.

221. THeſe muſcles are commonly reckoned ſix in number; two flexors lying on the foreſide of the arm, called *biceps* and *brachiæus internus*; and four extenſors ſituated on the backſide, named *extenſor longus*, *extenſor brevis*, *brachiæus externus*, and *anconæus*. The terms of *brachiæus* and *extenſor brevis* are now become ſo indeterminate, as to be often taken for one another; as likewiſe thoſe of *biceps externus* and *brachiæus externus*, which the moderns have ſubſtituted in the room of the former.

222. Of the two anterior muſcles, I name one ſimply *brachiæus* with the ancients, the other *biceps* or *coraco-radialis*; and I call all the four poſterior muſcles *anconæi*, diſtinguiſhing them afterwards by the epithets of *major*, *minor*, *externus*, *internus*. Theſe four muſcles might be reduced to two, the anconæus and triceps; which laſt may again be diſtinguiſhed into major, longus or medius, externus and internus.

223. The diſpoſition and names of theſe muſcles, according to what has been ſaid, are theſe;

1. *Biceps ſive Caraco-radialis.*
2. *Brachiæus*, called commonly *Brachiæus Internus.*
3. *Anconæus Major*, called alſo *Extenſor Cubiti Longus.*
4. *Anconæus Externus.*
5. *Anconæus Internus.*
6. *Anconæus Minor*, called ſimply *Anconæus.*

Sometimes the anconæus externus, and ſometimes the internus is called *extenſor cubiti brevis*, or *brachiæus externus*.

224. Theſe muſcles move not only the fore-arm on the Os Humeri, but alſo the Os Humeri on the fore-arm; neither

are they all confined to theſe two motions alone; for the biceps or coraco-radialis and anconæus major may move the Os Humeri on the ſcapula, and the ſcapula on the Os Humeri. The biceps by its inſertion in the radius performs likewiſe the motion of ſupination, and that with much more force than the muſcles commonly aſſigned for that action by the name of *ſupinatores.*

225. The motions of the fore-arm on the Os Humeri are not all performed by theſe ſix muſcles alone. The *ſupinator longus*, as it is termed, aſſiſts therein, as has been already obſerved by Heiſter; and indeed it ſeems better fitted for that motion than for ſupination, as we ſhall afterwards ſee; and for that reaſon I rank it among the auxiliary muſcles which move the fore-arm on the Os Humeri, *&c.* by the name of *radialis longus.*

§ 1. *Biceps ſive Coraco-radialis.*

Situation and conformation.

226. This is a double muſcle made up of two long fleſhy bodies, more or leſs round, lying by the ſide of each other, on the middle anterior part, and a little toward the inſide of the arm. Theſe two bodies are ſeparated above, each of them ending in a ſmall tendon. As they run down they become contiguous, and afterwards cloſely united by one common broad tendon. The ancients, who looked upon the two ſuperior extremities as two heads, gave this muſcle the name of *biceps*, and from its inſertions I call it *coraco-radialis.*

Inſertions.

227. It is fixed by one of the ſuperior tendons, in the apex of the coracoide apophyſis of the ſcapula, on one ſide of the tendon of the coraco-brachialis, which adheres very ſtrongly to it. This tendon of the biceps is broader, ſhorter, and ſituated more internally than the other; the fleſhy body belonging to this tendon is longeſt, and conſequently runs higheſt up.

228. The other ſuperior tendon is ſmaller and longer than the former, and the fleſhy body belonging to it, ſhorter and more compounded. This tendon is lodged in the bony channel of the Os Humeri, being ſurrounded by a membranous vagina continued from the capſular ligament, and ending at the fleſhy body where it is entirely cloſed.

229. At the upper part of the groove, the tendon runs between the inſertions of the tendons of the ſupra-ſpinatus and ſubſcapularis; paſſes immediately over the head of the bone within the capſular ligament; then leaving the joint between the two tendons juſt mentioned, is covered by another ſhort vagina, and is inſerted above the glenoide cavity, in the ſuperior impreſſion of the neck of the ſcapula, near the baſis of the coracoide apophyſis.

230. The two fleſhy bodies thus ſeparately fixed by their ſuperior tendons approach by degrees as they deſcend, and before they reach the middle of the Os Humeri are cloſely united, forming afterwards a common tendon of a conſiderable breadth, which is inſerted laterally in the poſterior edge of the tuberoſity at the neck of the radius.

231. This inferior or common tendon of the biceps, a little before its inſertion, ſends off towards the internal condyle, an aponeuroſis, which increaſing obliquely in breadth on the ſame ſide, covers the inner and back parts of almoſt the whole fore-arm, eſpecially the muſcles which lie upon the ulna, where it is inſenſibly loſt. It likewiſe ſtrongly adheres to the muſcles named *pronator teres* and *radialis internus* on the foreſide of the joint of the elbow. *Aponeuroſis.*

232. Both the fleſhy bodies of the biceps contribute to the formation of this aponeuroſis, each of the two portions of which the common tendon is made up, furniſhing a ſeries of tendinous fibres, which, covering the foreſide of the true tendon, unite near the internal condyle by a particular kind of intertexture, and thus produce the aponeuroſis.

§ 2. *Brachiæus.*

233. This is an oblong, thick, and broad muſcle, lying immediately on the anterior part of the lower half of the Os Humeri. The upper part of it is forked or ſloped, and at the bending of the joint of the elbow, the lower part contracts. *Situation in general.*

234. It is fixed to the ſurface of the Os Humeri by a great number of fleſhy fibres, from the lower inſertion of the deltoides, almoſt down to the two foſſæ at the lower extremity of the bone, and from one edge of the foreſide of this lower extremity to the other. The fibres are *Inſertions.*

for the moſt part longitudinal, thoſe neareſt the ſurface of the muſcle being longeſt, the more internal growing gradually ſhorter.

235. The lateral fibres are a little oblique, and this obliquity increaſes in thoſe that lie loweſt. Theſe lateral fibres are partly fixed in the intermuſcular ligaments of the Os Humeri, of which ligaments, that which lies toward the internal condyle is longer and broader than that toward the external condyle. The loweſt of theſe fibres are very oblique, and form on each ſide a kind of ſmall ſeparate faſciculus.

236. In paſſing over the joint all theſe fibres contract in breadth, and afterwards end in a ſtrong flat tendon inſerted in the muſcular impreſſion, which is directly below the coronide apophyſis of the ulna. This muſcle adheres very ſtrongly to the capſular ligament, and ſome of its fleſhy fibres terminate therein.

Connection.

237. The ſloped or forked ſuperior extremity of this muſcle embraces the large tendon of the deltoides. The internal point of the fork meets the inferior inſertion of the coraco-brachialis; and the foreſide of the whole muſcle is covered by the two fleſhy bodies of the biceps.

§ 3. *Anconæus Major.*

Situation in general.

238. This is a long fleſhy muſcle lying on the backſide of the Os Humeri.

Inſertions.

239. It is fixed above by a ſhort tendon to the inferior impreſſion in the neck of the ſcapula, and to a ſmall part of the inferior coſta of that bone. From thence it paſſes between the extremities of the ſubſcapularis and teres minor, and having reached the backſide of the lower extremity of the Os Humeri, it ends obliquely in a ſtrong broad tendon, which adhering cloſely to the capſular ligament, is afterwards fixed by a broad inſertion in the rough tuberoſity on the upper ſide of the olecranum.

Connection.

240. It lies between the two lateral anconæi, and, by its adheſions to them, a triceps muſcle is formed, of which this is the middle portion, I call all theſe three muſcles *anconæi*, becauſe of their inſertions in the olecranum or ancon.

§ 4. *Anconæus Externus.*

Situation in general. 241. This is a long muſcle lying on the outer part of the backſide of the Os Humeri, from its neck to the external condyle.

Inſertions and connection. 242. It is fixed above in the neck of the Os Humeri under the inferior ſurface of the great tuberoſity, and under the inſertion of the teres minor, but a little more backward. It runs down by the anconæus major, adhering ſtrongly to the bone, except at that oblique depreſſion, on account of which this bone appears contorted, as was ſaid in the treatiſe of the ſkeleton. It is likewiſe fixed by ſome oblique fibres in the external intermuſcular ligament.

243. From all this ſpace the fleſhy fibres contract in breadth, being joined more or leſs obliquely to the outer edge of the tendon of the anconæus major, all the way to the olecranum. The termination of theſe two muſcles in the common tendon, forms a very acute angle, and repreſents a ſort of penniform muſcle.

§ 5. *Anconæus Internus.*

Situation in general. 244. This muſcle is ſhorter and more fleſhy than the anconæus externus, and lies toward the inner part of the lower half of the Os Humeri.

Inſertions and connection. 245. It is fixed above, under the lower extremity of the teres major, but a little more backward, and to the internal intermuſcular ligament, which makes a kind of ſeptum between this muſcle and the brachiæus. From thence the fibres contracting in breadth, paſs toward the tendon of the anconæus major, ſome of them running in between it and the bone, and are inſerted in the edge and inner ſide of that tendon.

§ 6. *Anconæus Minor.*

Situation in general. 246. This is a ſmall muſcle obliquely triangular, lying in the oblong foſſula on the outſide of the olecranum.

247. It is fixed by a ſmall but pretty ſtrong tendon, in the lower part of the external condyle of the Os Humeri. From thence the fleſhy fibres run down obliquely in a radiated form, and are inſerted in the bottom and whole poſterior edge of the foſſula already mentioned. *Inſertions.*

248. It is cloſely united to, and in ſome ſubjects ſeems to communicate by ſeveral fibres with the muſcle termed *ulnaris externus*; and its tendon adheres very ſtrongly to that of the anconæus externus. Some anatomiſts having confounded this muſcle with the ulnaris externus, have been ſeen to raiſe them together, looking afterwards in vain for the anconæus minor; which however is very eaſily diſtinguiſhed from the other by a fatty or cellulous line. *Connection.*

ART. VI.

The muſcles which move the radius upon the ulna.

249. THeſe muſcles are reckoned to be four in number, *viz.*

1. *Supinator Longus ſive Major.* 3. *Pronator Teres.*
2. *Supinator Brevis ſive Minor.* 4. *Pronator Quadratus.*

250. Theſe muſcles cannot move the radius on the ulna without moving it at the ſame time on the Os Humeri; but the radius may be moved on the Os Humeri without being moved on the ulna, and conſequently without the aſſiſtance of the muſcles commonly aſſigned to the radius.

251. I have already obſerved that the ſupinator longus does not belong more particularly to the radius than to the ulna; and that it is much better fitted for bending the fore-arm than for the ſupination of the radius, as ſhall be further ſhewn in deſcribing the uſes of the muſcles.

252. There are ſome caſes in which theſe muſcles cannot perform the motions either of ſupination or of pronation, without the aſſiſtance of thoſe that move the fore-arm on the Os Humeri, and even of ſome that move the Os Humeri on the ſcapula, as ſhall be ſhewn in ſpeaking of the uſes of muſcles.

§ I. Su-

§ 1. *Supinator Longus ſive Major.*

Situation in general

253. This is a long flat muſcle lying on the external condyle of the Os Humeri, and on the convex ſide of the radius from one end to the other.

Inſertions and connection.

254. It is fixed by fleſhy fibres to the external intermuſcular ligament, and to the criſta of the external condyle of the Os Humeri, for five or ſix fingers breadth above the condyle, between the brachiæus and anconæus externus. From thence it runs along the whole convex ſide of the radius, and is inſerted by a flat narrow tendon, a little above the ſtyloide apophyſis in the angle between the concave and flat ſides of the extremity of this bone.

§ 2. *Supinator Brevis ſive Minor.*

Stuation in general.

255. This is a ſmall thin fleſhy muſcle, ſurrounding a great portion of the upper third part of the radius.

Inſertions and connection.

256. It is fixed by one end to the lower part of the external condyle of the Os Humeri to the external lateral ligament of the joint, to the annular ligament of the radius, and to part of the lateral eminence in the head of the ulna.

257. From thence it paſſes obliquely over the head of the radius, covering ſome part of it, and running down upon, and in ſome meaſure ſurrounding the neck, it turns in under the bicipital tuberoſity, and is inſerted by the ſide of the interoſſeous ligament in the inſide of the ſuperior quarter of the bone, and even a little lower. In ſome ſubjects we may obſerve the marks of the paſſage of this muſcle over the outſide of the bone. It makes an angle with the pronator teres, reſembling the Roman V.

§ 3. *Pronator Teres ſive Obliquus.*

Situation in general.

258. This is a ſmall muſcle, broader than it is thick, ſituated on the upper part of the ulna oppoſite to the ſupinator brevis, with which it forms an angle like the letter V.

259. It is fixed to the internal condyle of the Os Humeri, partly by fleſhy fibres, and partly by a tendon common to it with the ulnaris internus. From thence it paſſes obliquely before the extremity of the tendon of the brachiæus, and reaches to the middle part of the convex ſide of the radius, where it becomes flat, and is inſerted below the ſupinator brevis by an extremity almoſt wholly fleſhy.

Inſertions.

260. It is called *teres* to diſtinguiſh it from the quadratus. The name of pronator ſuperior would be more proper, but that of pronator obliquus is the moſt proper of all.

§ 4. *Pronator Quadratus ſive Tranſverſus.*

261. This is a ſmall fleſhy muſcle nearly as broad as it is long, lying tranſverſely on the inſide of the lower extremity of the fore-arm.

Situation in general.

262. It is fixed by one ſide or edge in the long eminence at the lower part of the internal angle of the ulna, and by the other in the broad concave ſide of the lower extremity of the radius.

Inſertions.

263. It is wholly fleſhy, without any mixture of tendinous fibres. It is ſituated tranſverſely, but that extremity which lies on the radius is nearer the carpus than that on the ulna. It is of a moderate thickneſs; and the fibres neareſt the ſurface are the longeſt, the reſt decreaſing in proportion as they lie near the interval between the two bones and the interoſſeous ligament.

264. It has a ligamentary or tendinous frænum belonging to it, one end of which is fixed in the interoſſeous ligament, the other in the inner edge of the baſis of the radius.

ART. VII.

The muſcles which move the carpus upon the fore-arm.

265. THE muſcles that immediately perform the motions of the carpus on the fore-arm, are ſix in number, *viz.*

1. *Ulnaris Internus*
2. *Radialis Internus.*
3. *Ulnaris Externus.*
4. 5. *Radialis Externus*, which is really two muſcles, whereof one may be termed *Radialis Externus primus*, the other *Radialis Externus ſecundus.*
6. *Ulnaris Gracilis*, called commonly *Palmaris Longus.*

They have the names of *ulnaris* and *radialis* from their ſituation, being all ſituated along the ulna and radius.

266. Theſe muſcles may likewiſe move the fore-arm on the carpus, and, in ſome caſes, they cannot without aſſiſtance perform the motions attributed to them.

267. The auxiliary muſcles which aſſiſt in moving the carpus on the fore-arm, belong to the claſs of thoſe that move the fingers, as we ſhall ſee hereafter.

§ 1. *Ulnaris Internus.*

Situation in general.

268. This is a long muſcle, fleſhy at its upper extremity and tendinous at the other, ſituated on the outer part of the ulna.

Inſertions and connection.

269. It is fixed by its upper part on the backſide of the long or internal condyle of the Os Humeri, in that part of the olecranum which is next the condyle, along the upper half of the ulna very nearly; and to the middle common tendon of the neighbouring muſcle, termed commonly *profundus*.

270. It runs in the direction of the external angle of the ulna, and ends by a long tendon, in the Os Piſiforme or Orbiculare of the carpus, reaching likewiſe to the Os Unciforme, being united to the ligament common to theſe two bones.

§ 2. *Radialis Internus.*

Situation in general.

271. This is a long muſcle very like the foregoing, but ſituated more obliquely.

Inſertions and connection.

172. Its fleſhy portion is fixed by a ſhort tendon, to the outer and upper ſide of the inner condyle of the Os Humeri. From thence it paſſes obliquely toward the radius, and running along about two thirds of that bone, it forms a long tendon which continues in the ſame courſe, and at the lower extremity of the radius, paſſes under a particular annular ligament, and under the inſertion of the muſculus thenar.

273. This tendon is at length inſerted chiefly in the inſide of the baſis of the firſt metacarpal bone, and often in the ſecond likewiſe, and a little in the firſt phalanx of the thumb,

having firſt paſſed through the channel of the Os Trapezium, which ſuſtains the thumb.

§ 3. *Ulnaris Externus.*

274. This is a long muſcle lying on the outſide of the fore-arm, fleſhy toward the Os Humeri and tendinous toward the carpus. *Situation in general.*

275. It is fixed above to the external condyle of the Os Humeri, being there united to the anconæus minor; to the annular ligament of the head of the radius, and to the upper half of the external angle of the ulna. From thence it advances and forms a tendon, which paſſes through the external notch at the lower extremity of this bone, on one ſide of the ſtyloide apophyſis. *Inſertions.*

276. The tendon having afterward paſſed under a particular ligament ſituated near the Os Cuneiforme of the carpus, is inſerted in the outſide of the baſis of the fourth metacarpal bone, ſending ſome tendinous filaments to the baſis of the little finger. It is likewiſe often fixed in the baſis of the third metacarpal bone.

§ 4. *Radialis Externus Primus & Secundus.*

277. Theſe are two muſcles cloſely united together, appearing at firſt ſight like one muſcle lying along the external angle of the radius, between the Os Humeri and the carpus, being fleſhy near the former and tendinous near the latter. *Situation in general.*

278. In many ſubjects we find theſe two muſcles entirely diſtinct from one end to the other; and they may be named *radialis externus primus & radialis externus ſecundus*, regard being had to the inſertion of their tendons. Sometimes the two fleſhy portions adhere cloſely together, appearing to make but one body, but the tendons are always diſtinct and ſeparate. *Diviſion.*

279. The firſt is inſerted above, in the criſta of the external condyle of the Os Humeri, below the inſertion of the ſupinator longus. The ſecond is inſerted in the ſame condyle below the inſertion of the firſt; and in the neighbouring articular ligament. From thence the two fleſhy *Inſertions,*

bodies run down very cloſe together, and having reached the middle of the outſide of the radius, each of them terminates in a long tendon.

280. The two tendons accompany each other to the extremity of the radius, and having paſſed under a particular annular ligament, they are divided as it were into two cornua, from whence the ancients, who looked upon them as one muſcle, gave it the name of *bicornis*.

281. One of theſe tendons is inſerted anteriorly in the baſis of the firſt metacarpal bone, the other nearly in the ſame place of the ſecond bone, which is the reaſon why I choſe to diſtinguiſh them by the names of *primus* and *ſecundus*. The tendon of the firſt is ſometimes double, appearing like another bicornis.

§ 5. *Ulnaris Gracilis, vulgo Palmaris Longus.*

Situation in general. 282. This is a ſmall muſcle lying between the Os Humeri and the carpus on the inſide of the fore-arm, its body being ſmall and ſlender, its tendon very long and flat.

Inſertions. 283. It is fixed by its fleſhy portion, in the ſmall criſta of the inner condyle of the Os Humeri, ſometimes cloſely united to the ulnaris internus. From thence it runs down fleſhy for ſome ſpace, turning a little obliquely towards the middle of the fore-arm, and ends in a long, narrow, thin tendon.

284. This tendon paſſes down the middle of the fore-arm, over all the other muſcles to which it ſlightly adheres, and advancing over the large internal annular or tranſverſe ligament of the carpus, is inſerted in the ſurface thereof, ſending off ſome radiated filaments to the aponeuroſis palmaris.

285. I have found this muſcle fixed to the condyle of the Os Humeri by a tendon about a finger's breadth in length, to which the fleſhy body was joined toward the middle of the fore-arm.

286. I have likewiſe ſeen the inferior tendon inſerted in the Os Scaphoides of the carpus, without communicating with the large annular ligament; and I have ſeen the aponeuroſis palmaris ariſe from this ligament; from all which it may

reaſonably be concluded, that that aponeuroſis has no eſſential dependance on this muſcle.

287. Sometimes this muſcle appears to be only a production from the ulnaris internus.

§ 6. *Palmaris Cutaneus.*

288. This muſcle, commonly known by the name of *palmaris brevis*, does not belong to this place, where my deſign is to mention no muſcles but thoſe which are ſolely fixed in bones. But as it is uſually ranked among the muſcles belonging to the upper extremity; and conſequently the deſcription of it would never be looked for any where elſe, I have choſen to inſert it here.

289. It is a ſmall thin plane of fleſhy fibres ſituated tranſverſely, or more or leſs obliquely under the ſkin of the large eminence in the palm of the hand, between the carpus and the little finger; its fibres adhering to the ſkin, and being in ſome meaſure interwoven with the membrana adipoſa.

290. Theſe fibres are fixed along the edge of the aponeuroſis palmaris from the large ligament of the carpus toward the little finger; and they run in for ſome ſpace on the plane of the aponeuroſis, but without any connection with the bones of the metacarpus. Near the aponeuroſis theſe fibres are more or leſs tendinous, and ſome of them often croſs each other. They are ſometimes ſo thin and pale, as hardly to be ſenſible; and in ſome ſubjects this muſcle ſeems to be divided into ſeveral parts.

ART. VIII.

The muſcles which move the bones of the metacarpus.

291. THere is one muſcle which very viſibly moves the fourth metacarpal bone on the Os Unciforme of the carpus, and thereby draws the third metacarpal bone along with it. This muſcle, which may be termed *metacarpius*, has been always hitherto looked upon as a portion of a muſcle belonging to the little finger.

292. The metacarpal bones are likewiſe moved on the car-

pus by the ulnares and radiales, and by all the muſcles in general that go to the fingers, as by ſo many auxiliaries.

293. The number of metacarpal muſcles would be increaſed, were the firſt phalanx of the thumb looked upon as a metacarpal bone.

Metacarpius.

Situation in general.

294. This is a ſmall very fleſhy muſcle, ſituated obliquely between the large internal annular or tranſverſe ligament of the carpus, and the whole inſide of the fourth metacarpal bone.

Inſertions.

295. It is fixed by a ſmall ſhort tendon to the Os Orbiculare, and to the neighbouring part of the large ligament of the carpus. From thence its fibres run more or leſs obliquely toward the inſide of the fourth metacarpal bone, in the outer edge of which they are inſerted. The fibres of this muſcle are of unequal lengths, and extend all the way to the articulation of the firſt phalanx of the little finger with the fourth metacarpal bone, but they have no mannner of relation to that finger.

ART. IX.

The muſcles which move the fingers.

296. THeſe muſcles may be divided into thoſe which move the thumb, and thoſe which move the other four fingers. Both theſe may again be divided into large or long, and ſmall or ſhort muſcles. The diſtinction of theſe muſcles into common and proper is not ſuitable, becauſe theſe two terms are afterwards uſed as the proper names of ſome particular muſcles which move the four fingers.

297. I ſaid in the beginning of this treatiſe, that for muſcles ſolely fixed in bones, I would make uſe of no names taken from the functions attributed to them. However, as the greateſt part of the muſcles of the fingers and toes have proper names, and only a few of them are called flexors or extenſors, theſe names may ſtill be retained, provided they be looked upon only as proper names, as ſhall be ſaid at more length hereafter.

298. The muſcles belonging to this article are theſe:

1. *Flexor Pollicis Longus.*
2. *Extenſor Pollicis Longus.*
3. *Thenar.*
4. *Meſothenar.*
5. *Antithenar.*
6. *Perforatus.*
7. *Perforans.*
8. *Extenſor Digitorum communis.*
9. *Extenſor Indicis Proprius.*
10. *Extenſor Minimi Digiti Proprius.*
11. *Lumbricales.*
12. *Interoſſei.*
13. *Semi-interoſſeus Indicis.*
14. *Hypothenar Parvus.*

§ 1. *Flexor Pollicis Longus.*

Situation and inſertions.

299. This is a long muſcle, fixed by ſhort and oblique fleſhy fibres to the inſide of the upper part of the interoſſeous ligament near the radius, and along that bone all the way down to the pronator quadratus. There it terminates in a flat tendon, which is inſenſibly formed from the very beginning of its ſuperior inſertion, by all the fleſhy fibres of which the muſcle is made up.

300. This tendon having paſſed under a particular ligament, runs in between the two portions of the thenar, and then into a ſort of groove left between the two ſeſamoide bones fixed to the baſis of the ſecond phalanx of the thumb, on that ſide which is turned to the palm of the hand. Afterwards the tendon ends in the flat ſide of the third phalanx near its baſis. It is incloſed in a ligamentary vagina from the annular ligament to its inſertion, and it is divided or ſlit, ſo that it appears to be inſerted by two extremities adhering together by their edges.

§ 2. *Extenſores Pollicis.*

Diviſion and ſituation in general.

301. Theſe are two very diſtinct muſcles, the firſt or longeſt of which is ſometimes more, ſometimes leſs, and ſometimes altogether divided into two, in which caſe theſe muſcles are three in number. They are ſituated obliquely between the ulna and convex ſide of the thumb.

302. The extenſor primus is a long muſcle, more or leſs

double in the manner already ſaid. It is fixed above by fleſhy fibres, firſt to the outſide of the ulna near its upper extremity, below the anconæus minor and inſertion of the ulnaris externus: next to the interoſſeous ligament under the ſupinator brevis; and laſtly, to the middle part of the outſide of the radius.

303. From thence it runs down and paſſes anteriorly over the lower part of the radius and tendons of the ſupinator longus and radialis externus, and being gradually divided, it terminates in two long flat tendons, more or leſs ſubdivided, which paſs together under a particular annular ligament, being only parted by ſepta or fræna belonging to that ligament.

304. The firſt of theſe two principal tendons is inſerted in the edge of the baſis of the firſt phalanx, near the large tranſverſe ligament of the carpus. When this tendon is ſubdivided, the other portion of it is fixed in that bone of the carpus which ſuſtains the thumb. The other principal tendon, which often belongs to a muſcle entirely diſtinct from the former, is fixed in the convex ſide of the baſis of the ſecond phalanx, where it joins the tendon of the extenſor ſecundus. On account of theſe different inſertions of the two tendons, this muſcle is by ſome authors deſcribed as two.

305. The extenſor ſecundus is ſhorter than the firſt. It is fixed to the ulna below the former, and above the inſertion of the extenſor indicis proprius, and likewiſe to the neighbouring part of the interoſſeous ligament. From thence it runs down obliquely on the middle part of the radius, where it has likewiſe a ſmall adheſion. Afterwards it paſſes through the ſmall channel in the ſtyloide apophyſis of the radius, through the annular ligament belonging to the tendons of the radialis externus, and over theſe tendons, being parted from them by a ſmall ligamentary ſeptum. It is inſerted in the convex part of the third phalanx near its baſis, having, as it paſſes over the ſecond phalanx, joined the ſecond or collateral tendon of the firſt extenſor, more or leſs.

§ 3. *Thenar.*

Situation in general.

306. This is a very thick fleſhy muſcle in ſome meaſure pyriform, lying on the firſt phalanx of the thumb toward the palm of the hand, the large eminence

in which is chiefly formed by it. Its name is taken from a Greek word which ſignifies *to ſtrike.*

307. It is fixed to the bone which ſupports the thumb, and to the neighbouring part of the great internal annular or tranſverſe ligament of the carpus. It is in ſome meaſure bicipital, two diſtinct portions anſwering to the two inſertions already mentioned. As it runs along the firſt phalanx theſe two portions unite, and diminiſhing in thickneſs, are both inſerted by one tendon in the lateral internal part of the head of the firſt phalanx, in the lateral part of the baſis of the ſecond, and in the lateral ligament of that joint.

308. The void ſpace between the two portions of this muſcle gives paſſage to the tendon of the flexor pollicis longus. That portion which lies neareſt the hollow of the hand, is the largeſt, and its tendinous extremity is inſerted in the firſt ſeſamoide bone ſituated at the baſis of the ſecond phalanx.

§ 4. *Meſothenar.*

Situation in general

309. This is a flat and nearly triangular muſcle lying between the firſt phalanx of the thumb, and the bottom of the palm of the hand.

Inſertions.

310. It is inſerted by a very broad baſis in the ligament which connects the Os Magnum of the carpus to that which ſupports the thumb. It is likewiſe inſerted along the internal or angular part of that bone of the metacarpus, which ſupports the middle finger, and in the ſmall extremity of that which anſwers to the index.

311. From thence the fibres contracting to an angle, terminate in a flat tendon of different breadths, which is inſerted in that ſide of the head of the firſt phalanx of the thumb, which is turned to the hollow of the hand, and in the neighbouring part of the baſis of the ſecond phalanx, by means of the ſecond ſeſamoide bone belonging to that joint.

§ 5. *Antithenar ſive Semi-Interoſſeus Pollicis.*

Situation in general.

312. This is a ſmall flat fleſhy muſcle ſituated obliquely, between the firſt phalanx of the thumb, and firſt bone of the metacarpus.

313. It is fixed by one end toward the baſis of the firſt metacarpal

Inſertions. metacarpal bone, near the firſt bone of the ſecond row of the carpus. From thence it runs obliquely toward the head of the firſt phalanx of the thumb, and is inſerted in the lateral external part of that bone, or on that ſide which is turned to the firſt metacarpal bone. It croſſes over the ſemi-interoſſeous indicis, this muſcle lying toward the back of the hand, and the antithenar toward the palm.

§ 6. *Perforatus vulgo ſublimis.*

314. This is a muſcle of a conſiderable volume lying along the inſide of the fore-arm, fleſhy for the greateſt part near the articulation of the fore-arm with the Os Humeri, and near the carpus terminating in four diſtinct portions, which become the ſame number of long ſmall tendons. The name of *ſublimis* has been given to it, becauſe it lies almoſt on the ſurface of the fore-arm; and that of *perforatus* from the ſlits found near the extremities of its tendons. *Situation in general.*

315. It is commonly made up of four muſcles cloſely united by their fleſhy portions repreſenting there one large body of muſcles. It is fixed above to the ſuperior internal parts of the ulna and radius, (this laſt bone being conſidered in its natural ſituation), and to that of the interoſſeous ligament. A little below the middle of the fore-arm, this large fleſhy body is divided into four diſtinct muſcles, which, on the loweſt quarter of the fore-arm, end in four flat tendons of different ſizes. *Diviſion and inſertions.*

316. Theſe four tendons are incloſed in a common membranous or mucilaginous vagina, which likewiſe furniſhes each tendon with a particular thin vagina. In this manner they advance to the carpus, and paſs under the large annular tranſverſe ligament. Beyond this ligament they ſpread again in the palm of the hand, ſtill retaining their particular vaginæ, and run between the aponeuroſis palmaris and metacarpus toward the fingers, ſeparating more and more by degrees. Sometimes there are at firſt only three tendons, one of them being afterwards divided into two, in their paſſage to the fingers; ſometimes they communicate by a kind of detachment, with the tendons of the perforans.

317. Having reached the heads of the metacarpal bones, they paſs under the four arches or fræna formed by the furcæ of the aponeuroſis palmaris, and particular ſepta of the great tranſverſe ligament of the palm of the hand; and then each tendon having got beyond the head of one metacarpal bone, and beyond the baſis of the firſt phalanx, enters the ligamentary vagina on the flat or inner ſide of that phalanx, and is inſerted in the flat ſide of the ſecond phalanx near its baſis, the membranous vagina accompanying it to its inſertion. The ligamentary vagina is ſtronger towards the baſis than toward the head of the firſt phalanx.

318. In paſſing along the inſide of the firſt phalanx, the tendon is divided by a long ſlit which gives paſſage to a tendon of the perforans, and from thence the names of theſe two muſcles are taken.

319. This fiſſure or opening is contrived in a very ſingular manner; the tendon is firſt of all divided in two flat portions, and each portion is contorted on the flat ſide of the phalanx; ſo that the edges which were neareſt become oppoſite, and the oppoſite edges are joined together all the way to the extremity of the tendon. By this contorſion the fiſſure ſeems to form two ſmall oblique grooves, which ſurround the tendon in oppoſite directions, one groove being covered by the tendon, and the other covering it.

320. This is not all: The two portions having formed this double groove by their mutual contorſion, are not united, only by ſimply approaching each other at their extremities; for each portion is at that place again divided into two others, ſmaller and ſhorter than the former; ſo that in all there are four narrow portions; the two neareſt of which croſs each other, and join the other two; ſo that from the four narrow ones are formed two broad portions anew, which are joined by their edges, and afterwards inſerted in the bone at a ſmall diſtance from each other.

§ 7. *Perforans vulgo Profundus.*

Situation in general and diviſion.

321. This muſcle is very like the former, and it is ſituated much in the ſame manner, only it lies lower, and is covered by the perforatus. It

is compoſed of four muſcles, which at firſt ſeem to make but one maſs, and afterwards terminate in four tendons.

Inſertions. 322. The fleſhy portions of the firſt and largeſt, and alſo of the ſecond, are fixed in the ſuperior parts of the ulna and interoſſeous ligament down to their middle; the fleſhy portion of the third is joined to the tendon of the ulnaris internus by a ſort of common aponeuroſis, and that of the fourth is fixed along the ulna.

323. The four tendons have often ſeveral ſmall collateral tendons, ſometimes five in number, united to the tendons of the neighbouring muſcle, as they paſs under the large annular ligament of the carpus; but the tendons themſelves are ſeparated from the others by thin ſepta, which form a kind of particular rings. Being thus ſtrengthened they ſeparate, and running along the palm of the hand in diſtinct membranous vaginæ, like thoſe of the perforatus by which they are covered, they enter the ligamentary vaginæ of the firſt phalanges together with the former; and having paſſed through the fiſſures thereof and through the ligamentary vaginæ of the ſecond phalanges, they are inſerted in the flat inner ſide of the third near their baſis.

324. The ligamentary vaginæ of the ſecond phalanges appear ſometimes ſtronger near the baſis than near the heads of the bones.

§ 8. *Extenſor Digitorum Communis.*

Situation in general. 325. This is a compound muſcle very much reſembling the perforatus and perforans, lying on the outſide of the fore-arm between the ulnaris externus and radialis externus.

326. It is fixed above by a tendinous extremity, to the poſterior and lower part of the external or great condyle of the Os Humeri, and by a tendinous adheſion on each ſide, to the ulnaris and radialis externus. It has likewiſe ſometimes a ſmall inſertion in the radius. It is divided into four muſcles like the perforatus and perforans, and four long ſlender ſmall tendons. *Inſertions and diviſion.*

327. Three of theſe tendons paſs through the common external annular ligament of the carpus; and the fourth, which goes to the little finger, and which has ſometimes its fleſhy

portion diſtinct from the reſt, paſſes through a particular ring of the ſame ligament.

328. Afterwards theſe four tendons ſeparate as they go to the fingers, and in their paſſage communicate with each other by oblique tendinous ſeries chiefly near the heads of the metacarpal bones. The tendons of the middle and little finger are ſometimes double, and yet communicate with the reſt.

329. Each tendon having reached the baſis of the firſt phalanx, is ſlightly inſerted therein by ſome lateral expanſions fixed in each ſide of the baſis. From thence it advances to the head of the ſame phalanx, where it is divided into two flat portions, which, at the articulation of the firſt phalanx with the ſecond, leave ſome diſtance between them. About the head of the ſecond phalanx they unite again, and are fixed in the convex ſide of the third phalanx near its baſis. The ſeparation of the two portions is in ſome ſort rhomboidal, and each portion is ſtrengthened by a common tendon of the lumbricales and interoſſei. In the void ſpace between them are ſmall tendinous fræna, more or leſs tranſverſe.

§ 9. *Extenſor Indicis Proprius.*

Situation in general.

330. This is a ſmall long muſcle with a long ſlender tendon, lying a little obliquely on the lower and outer half of the fore arm between the ulna and fore-finger.

Inſertions.

331. It is fixed by its fleſhy body a little higher than the loweſt third part of the outſide of the ulna, below the inſertion of the extenſor policis, and it has likewiſe a ſmall adheſion to the interoſſeous ligament. From thence it runs down, ending in a diſtinct tendon without any communications, which having paſſed through the annular ligament of the extenſor communis, afterwards joins that tendon which goes to the index.

§ 10. *Extenſor Minimi Digiti Proprius.*

Situation in general

332. This is a kind of collateral or auxiliary muſcle of the extenſor communis, of which it appears almoſt to be more or leſs a portion.

333. It is fixed along the ſuperior external half of the ulna, from whence its long ſmall tendon runs down in company with the fourth tendon of the extenſor communis, all the way to the little finger, where it joins it, and is inſerted with it. Sometimes this muſcle is wanting, in which caſe the extenſor communis ſends a double and ſometimes a triple tendon to the little finger.

Inſertions.

§ 11. *Lumbricales.*

Situation in general.

334. Theſe are four very ſmall ſlender muſcles lying in the hollow of the hand, in the ſame direction with the perforatus and perforans.

Inſertions.

335. They are fixed by their fleſhy bodies to the tendons of the perforatus on the ſide next the thumb, near the large annular ligament of the carpus. Near the heads of the metacarpal bones they become very thin tendons, which accompany thoſe of the perforans through the furcæ of the aponeuroſis palmaris. Then they paſs on to the ſame ſides of the firſt phalanges, and join the tendons of the extenſor communis; each of them being connected with the neareſt portion thereof, at the articulation of the firſt phalanx with the ſecond.

336. Theſe tendons are likewiſe united to ſome of the interoſſei, and their inſertions ſeem to vary in different ſubjects; for though they lie generally on that ſide of the fingers which is next the thumb, yet, if I am not miſtaken, I have obſerved the firſt inſerted in the index on the ſide next the thumb, the ſecond and third on each ſide the middle finger, and the fourth in that ſide of the ring-finger which is fartheſt from the thumb.

§ 12. *Interoſſei.*

Situation in general and diviſion.

337. Theſe are ſmall muſcles lying between the metacarpal bones, and filling the three interſtices left between them, both exteriorly or toward the back of the hand, and interiorly or toward the palm of the hand. From this ſituation they have the name of *interoſſei*, and have been divided into external and internal. They are commonly reckoned ſix in number,

three external and three internal, regard being had only to the fleſhy maſſes in the metacarpus, and to the ſix tendinous inſertions in the fingers; but if we conſider the compoſition of theſe maſſes, their number may be increaſed.

338. The external interoſſei are ſtronger, more compound, and take up more ſpace between the metacarpal bones than the internal. Each of them is made up of two portions, one of which appears almoſt on a level with the bones, the other hid, and which runs in upon the internal muſcles.

339. The apparent portion is in ſome meaſure penniform, being fixed along the ſides of two bones, and alſo by a ſmall extremity to the neareſt bone of the carpus. The other portion which lies hid appears more ſimple, and ſeems to be fixed only to the baſes of the ſame two bones.

340. Near the heads of the metacarpal bones, theſe two portions of each muſcle end in broad flat tendons, which having reached the ſide of the firſt phalanx of one finger, are afterwards united with the neareſt portion of the tendon of the extenſor communis. One portion is likewiſe inſerted in the phalanx itſelf, by ſmall ſhort tendons. Theſe muſcles may therefore be reckoned bicipital, eſpecially when the tendons of the two portions unite.

341. The firſt two external interoſſei are for the moſt part inſerted in the middle finger. They fill the interſtices between the three firſt metacarpal bones, and ſurround the middle bone all the way to the hollow of the hand. Their tendons are fixed in both ſides of the firſt phalanx, and in both ſides of the ſecond tendon of the extenſor communis.

342. The third external interoſſeus lies in the interſtice betwixt the two laſt metacarpal bones, and is moſt commonly inſerted in the ring-finger; its tendon being fixed in that ſide of the firſt phalanx fartheſt from the thumb, and in the correſponding edge of the third tendon of the extenſor communis. The fleſhy body of this muſcle runs in between the two bones toward the hollow of the hand.

343. The internal interoſſei are more ſimple than the former, and do not lie ſo much between the bones. The tendon of the firſt is inſerted in the ſide of the firſt phalanx of the fore-finger, next the little finger, and in the correſponding edge of the extenſor communis. The tendon of the ſecond goes in the ſame manner to the ſide of the ring-

finger next the thumb; and the third to the ſame ſide of the little finger.

344. There are therefore two external interoſſei for the middle finger, one for the ring-finger, but none for the fore and little finger. The middle finger has no internal interoſſeous; but the index, ring-finger, and little finger, have each of them one.

345. The external interoſſei appear ſometimes to be really double, the two muſcles being ſeparated by a fatty line; ſo that in ſome ſubjects we have ſix internal interoſſei. But the fleſhy portions on each ſide of the ſecond metacarpal bone belong to the two firſt external muſcles; and the fleſhy portion on the ſide of the fourth metacarpal bone next the thumb, belongs to the third external interoſſeus, according to the diſpoſition in which I have deſcribed them.

§ 13. *Semi-interoſſeus Indicis.*

Situation in general. 346. This is a ſmall, ſhort, flat, fleſhy muſcle, very like the antithenar or internal ſemi-interoſſeous of the thumb. It is ſituated obliquely on one ſide of that of the thumb, between the firſt phalanx thereof, and firſt metacarpal bone.

Inſertions. 347. It is fixed by one end to the outſide of the baſis of the firſt phalanx of the thumb, and a little to that bone of the carpus by which this phalanx is ſupported; and by the other end it is fixed near the head of the firſt phalanx of the index, on that ſide next the thumb. It lies almoſt parallel to the antithenar, croſſing over it a little; this muſcle lying on the convex ſide of the hand, and the antithener on the concave ſide.

§ 14. *Hypothenar Minimi Digiti.*

Situation in general. 348. This is a ſmall and pretty long muſcle lying on the back ſide of the fourth metacarpal bone oppoſite to the thumb, where, together with the metacarpius or hypothenar metacarpi, it forms that large eminence over-againſt the thenar, or that of the thumb. It may be called *hypothenar minor*, and that of the metacarpus, *hypothenar major*.

349. It is fixed by one end to the Os Orbiculare of the carpus,

pus, and a little to the neighbouring part of the large annular ligament. The other end terminates by a ſhort flattiſh tendon fixed to that ſide of the baſis of the firſt phalanx of the little finger which is turned from the thumb. This muſcle covers the metacarpius a little, and they have both been looked upon as portions of one hypothenar.

Inſertions.

ART. X.

The Muſcles which move the Os Femoris upon the Pelvis.

350. THESE muſcles are commonly twenty-two in number, ſixteen of which are inſerted in the Os Femoris, and ſix move it without being fixed to it.

351. Theſe muſcles only which are inſerted in the Os Femoris are reckoned to belong to the thigh, and they are commonly ſaid to be fourteen in number, but it is eaſy to make out ſixteen very diſtinct from each other. Of theſe ſixteen three lie on the fore and upper part of the thigh, *viz.*

1. *Pſoas.* 2. *Iliacus.* 3. *Pectineus.*

352. On the inſide of the thigh are three, commonly reckoned one, by the name of *triceps*, though, according to the ancient language, it has three tails, as well as three heads and three bellies, and therefore might more properly be called *triplex*.

4. *Triceps ſive Triplex Primus.* 6. *Triceps Tertius.*
5. *Triceps Secundus.*

353. Three form the buttocks, and are called,

7. *Glutæus Maximus.* 9. *Glutæus Minimus.*
8. *Glutæus Medius.*

354. There are ſix very ſmall muſcles, more or leſs hid under the glutæi, the four firſt of which are by ſome termed *quadrigemini*. The particular names of theſe ſix are:

10. *Pyriformis.*
11. *Gemellus Superior.*
12. *Gemellus Inferior.*
13. *Quadratus.*
14. *Obturator Externus.*
15. *Obturator Internus.*

355. Laſtly, there is a ſmall anterior ſuperficial muſcle, commonly but falſely termed *faſcia lata*, which is a large membranous, tendinous, or ligamentary covering, to which the greateſt part of this ſmall muſcle is fixed; and therefore it ought not to be called by the name of that membrane without reſtriction, that is, without the addition of *muſculus* in this manner:

16. *Muſculus Faſciæ latæ, ſive Muſculus Membranoſus.*

356. The ſix muſcles which move the Os Femoris without being inſerted in it, belong to the claſs of thoſe which move the leg upon the thigh, *viz.*

17. *Sartorius.*
18. *Rectus Gracilis.*
19. *Rectus ſive Gracilis internus.*
20. *Semi-membranoſus.*
21. *Semi-nervoſus.*
22. *Portio Bicipitis longa.*

357. All theſe muſcles, whether inſerted or not inſerted in the Os Femoris, not only move that bone on the pelvis, but may alſo move the pelvis on the Os Femoris.

Faſcia lata.

358. The faſcia lata already mentioned ſurrounds more or leſs all theſe muſcles. It is a muſcular ligament very conſiderable both for its extent and ſtrength, being made up chiefly of two planes of fibres, of which the external are more or leſs longitudinal; the internal more or leſs tranſverſe. It is further ſtrengthened in ſome places by a great number of other fibres, which augment its thickneſs and form particular expanſions The tranſverſe fibres are much ſtronger than the longitudinal.

359. It is fixed above to the edge of the criſta Oſſis Ilium, from the large tuberoſity to the anterior ſuperior ſpine; to the ligamentum Falloppii, and to the aponeuroſis of the obliquus externus of the abdomen, on which it runs up by a thin lamina. It is likewiſe fixed in the lateral inferior part of the Os Sacrum, and to the neighbouring parts of the ligaments by which that bone is connected to the Oſſa Ilium and Iſchium.

360. From thence it advances over the glutæi and thigh between the membrana adipoſa and muſcles, all the way to the anterior and outer parts of the knee. It is very thin on the patella, but may be ſeparated from it. It is likewiſe continued over the external anterior part of the tibia, covering

the muſcles which lie there, and is ſtrongly inſerted in the head and criſta of that bone, and in the upper part of the fibula.

361. It ſends off elongations, which, like ſo many ſepta, run in between the muſcles, and ſometimes meet in ſuch a manner as to form vaginæ. It is ſtrongeſt on the anterior and outer parts of the thigh, growing gradually thinner on the inner and back parts.

362. It is ſtrongly inſerted in the linea femoris aſpera between the vaſtus externus and biceps, forming a ſort of ſeptum between theſe muſcles. It furniſhes particular vaginæ to the muſcles which lie on the inſide of the thigh; and though theſe vaginæ are thin, they are nevertheleſs pretty ſtrong, being chiefly made up of tranſverſe fibres.

§ 1. *Pſoas ſive Lumbaris Internus.*

Situation in general.

363. This is a long thick muſcle ſituated in the abdomen on the lumbar region, adhering to the vertebræ of the loins, from the poſterior part of the Os Ilium to the anterior part near the thigh.

Inſertions.

364. It is fixed above to the laſt vertebra of the back and to all thoſe of the loins, that is, to the lateral parts of the bodies of theſe vertebræ, and to the roots of their tranſverſe apophyſes. The inſertions in the bodies of the vertebræ are by a kind of digitations, and are very little tendinous.

365. From thence the muſcle runs down laterally over the Os Ilium, on one ſide of the iliac muſcle, and paſſes under the ligamentum Falloppii, between the anterior inferior ſpine of the Os Ilium, and that eminence, which, from its ſituation, may be termed *ilio-pectinea.*

366. Before it goes out of the abdomen, it unites with the iliacus, and is ſometimes fixed by a few fleſhy fibres, in the outſide of the eminence laſt mentioned. It afterwards covers the foreſide of the head of the Os Femoris, and is inſerted in the forepart of the little trochanter by an oblique tendon, which is folded double from behind forward.

367. This muſcle is ſometimes accompanied by another ſmaller muſcle almoſt like it, called *pſoas parvus,* which I have

ranked among the muſcles of the loins, becauſe it ſeldom reaches lower than the pelvis.

§ 2. *Iliacus.*

Situation in general. 368. This is a broad thick muſcle lying on the whole inſide of the Os Ilium.

369. It is fixed by fleſhy fibres to the internal labium of the criſta Oſſis Ilium, to that of the ſlope between the two anterior ſpines, to the inſides of theſe ſpines, to the ſuperior half of the inſide of this bone, and to the neighbouring lateral part of the Os Sacrum. *Inſertions.*

370. All theſe fibres contracting by degrees run obliquely towards the lower part of the muſculus pſoas, uniting therewith, and being fixed by a kind of aponeuroſis to the outſide of its tendon all the way to the little trochanter. They cover the head of the Os Femoris, and ſome of the loweſt are inſerted in that bone a little above and behind the little trochanter, and others a little lower down.

371. On the outſide of the lower extremity of the iliacus, there is ſometimes a ſmall ſeparate muſcle fixed immediately under the anterior inferior ſpine of the Os Ilium, from whence it runs obliquely downward, joins the iliacus, and is inſerted below the little trochanter. It repreſents, in ſome meaſure, a Roman V, with the pectineus, and might be reckoned an iliacus minor, if the large muſcle had not ſometimes an inſertion in the ſide of the eminence called *ilio-pectinea.*

372. The iliacus and pſoas thus united paſs under the ligamentum Falloppii, over the ſlope or channel between the anterior inferior ſpine of the Os Ilium and eminentia ilio-pectinea, in a ſort of ligamentary capſula very ſmooth and poliſhed, that part of it which covers the channel appearing like a cartilage.

§ 3. *Pectineus.*

Situation in general. 273. This is a ſmall flat and pretty long muſcle, broad at the upper part and narrow at the lower, ſituated obliquely between the Os Pubis and upper part of the Os Femoris. It is commonly a ſingle muſcle; but I have ſometimes found it double.

274. It

374. It is fixed above by fleſhy fibres to all the ſharp ridge or criſta of the Os Pubis, and to a ſmall part of the oblong notch or depreſſion on the foreſide of that criſta, in which the upper extremity of this muſcle is lodged.

Inſertions.

375. From thence it runs down obliquely towards the little trochanter, under and a little behind which, it is inſerted obliquely by a flat tendon, between the ſuperior inſertion of the vaſtus internus and inferior inſertion of the triceps ſecundus with which it is united.

§ 4. *Glutæus Maximus.*

376. This is a thick broad muſcle, reſembling the quadrant of a circle in figure, lying on the outſide of the Os Ilium and upper part of the Os Femoris.

Situation in general.

377. It is fixed wholly fleſhy to all the lateral poſterior parts of the Os Coccygis and Os Sacrum; to the ligamentum ſacro-ſciaticum; to the outſide of the tuberoſity of the Os Ilium; and from thence to the external labium of the criſta of that bone all the way to its higheſt part where this muſcle mixes fibres with the glutæus medius.

Inſertions.

378. It is likewiſe fixed to the inſide of the faſcia lata, at the places which anſwer to all the inſertions already mentioned, but through a much greater ſpace, and by a very great number of fleſhy fibres, almoſt in the ſame manner as we ſhall ſee in the external plane of the muſculus temporalis. The fibres which end in this faſcia become gradually ſhorter, as they are ſituated lower.

379. All theſe fibres contract in breadth in a radiated manner as they approach to the great trochanter, and afterwards form a ſtrong, flat, pretty broad tendon, about an inch in length, which is inſerted a finger's breadth or a little more below the great trochanter, in all that large longitudinal impreſſion at the upper part of the linea aſpera on the backſide of the Os Femoris, between the vaſtus externus and largeſt portion of the triceps.

380. This tendon is covered and ſtrengthened by a production of the faſcia lata, in which ſeveral fleſhy fibres of this muſcle are inſerted at that place. It is a very ſtrong ten-

don, and in this and other reſpects bears ſome reſemblance to that of the deltoides.

Connection. 381. This muſcle covers part of the glutæus medius; and at its inſertion in the Os Coccygis, it almoſt joins that of the glutæus maximus of the other ſide.

§ 5. *Glutæus Medius.*

Situation in general. 382. This is a radiated muſcle almoſt in the ſhape of a ſpread fan. It is pretty thick, and almoſt as broad as the whole outſide of the Os Ilium, being ſituated between the criſta of that bone and the great trochanter, and covered anteriorly by the faſcia lata, and poſteriorly by the glutæus maximus.

383 It is fixed above by fleſhy fibres to all that ſpace on the outſide of the Os Ilium, which lies between the external labium of the criſta, and the ſemicircular impreſſion which goes between the ſuperior and anterior ſpine, and the great poſterior ſinus.

384. It is likewiſe fixed in the edge of that ligament which goes between the lower part of the Os Sacrum and Os Ilium. Laſtly, the inner part of it which is covered only by the faſcia lata, is inſerted in the inſide of that faſcia, in the ſame manner as the glutæus maximus.

385. From thence all the fibres contract in breadth, more or leſs in a radiated manner, as they advance toward the great trochanter, and form a ſhort thick tendon which mixes a little anteriorly with the tendon of the glutæus minimus; and the moſt poſterior fibres gradually join the ſide of the tendon of the pyriformis.

386. The tendon is inſerted in the upper convex part of the great trochanter, from the apex of the large ſuperior external rough ſurface, all the way to the anterior rough ſurface, encompaſſing in a manner all that part of the trochanter.

Connection. 387. This is the broadeſt of all the glutæi. The diſpoſition of its fibres is not every where uniform; the anterior ſeries ſeeming to make a diſtinct portion, not by being ſeparated from the reſt, but by being differently directed, for they deſcend almoſt parallel to each other; whereas the middle and poſterior portions are in a more radiated diſpoſition; and the anterior portion is likewiſe more fleſhy and thick than the other two.

388. When this muſcle is inverted upward, its tendon being firſt cut off from its inſertion, we ſee a kind of tendinous arch running along its whole inſertion in the ſemicircular line.

§ 6. *Glutæus Minimus.*

Situation in general.

389. This is a ſmall, broad, radiated muſcle, ſituated on the outſide of the Os Ilium, under the other two glutæi.

Inſertions.

390. It is fixed above in all that portion of the outſide of the Os Ilium, which lies between the great ſemicircular line, and another ſmall one a little above the ſupercilium of the cotyloide cavity or acetabulum, running between the anterior inferior ſpine and the great poſterior ſinus. It is likewiſe fixed in the edge of that ſinus, in the ſpine of the iſchium, and in the orbicular ligament of the joint of the hip.

391. From thence its fibres, contracting in breadth, form a ſhort tendon, by which the muſcle is inſerted in the anterior part of the upper edge of the great trochanter, above the great external convex rough ſurface in which the glutæus medius is fixed; and alſo in an oblique ſurface which runs down a little way between that laſt named and the rough anterior ſurface.

392. The tendon is increaſed in breadth in its oblique courſe downward, and is likewiſe inſerted in the orbicular ligament chiefly by two particular tendinous productions or expanſions.

§ 7. *Triceps Primus.*

Situation in general.

393. This with the two following tricipital muſcles, are fleſhy and flat, and of different lengths, ſituated between the Os Pubis and the whole length of the Os Femoris, The firſt and ſecond croſs each other in ſuch a manner, as that the muſcle which is the firſt on the Os Pubis becomes the ſecond on the Os Femoris, and the ſecond on the Os Pubis is the firſt on the Os Femoris. The third muſcle keeps its rank.

394. The triceps primus is fixed above by a ſhort tendon

to

Inſertions. to the tuberoſity or ſpine of the Os Pubis, and to the neighbouring part of the ſymphyſis, its fibres mixing a little with thoſe of the pectineus. From thence it runs down, increaſing in breadth, and is inſerted by fleſhy fibres interiorly in the middle portion of the linea femoris aſpera.

395. At the lower part of this inſertion, a portion of the muſcle ſeparates from the reſt, and ſends off a long tendon, which, together with a like tendon from the triceps tertius, is inſerted in the inner condyle of the extremity of the Os Femoris.

§ 8. *Triceps Secundus.*

396. This muſcle is fixed above by fleſhy fibres, below *Inſertions.* the ſuperior inſertion of the triceps primus, in all the outſide of the inferior ramus of the Os Pubis, as low as the foramen ovale, but ſeldom ſo low as the ramus of the Os Iſchium. This inſertion is broader than that of the former muſcle.

397. From thence it runs down, and is inſerted in the upper part of the linea aſpera, between the pectineus and triceps primus, mixing a little with each of theſe muſcles. This inſertion appears ſometimes divided.

§ 9. *Triceps Tertius.*

398. This muſcle is fixed above by fleſhy fibres to the an- *Inſertions.* terior part of all the ſhort ramus of the Iſchium, and to a ſmall part of the tuberoſity of that bone. This inſertion covers ſome part of the tendon of the ſemi-membranoſus, and is covered by that of the ſemi-nervoſus.

399. From thence it runs down, and is inſerted by fleſhy fibres in the linea aſpera almoſt from the little trochanter down to the middle of the Os Femoris. It goes lower down than the firſt triceps, ſending off a ſeparate portion like that of the muſcle laſt mentioned.

400. Theſe two portions join together, and form a common tendon, which running down to the lower extremity of the Os Femoris, is inſerted in the back part of the tuberoſity

of the inner condyle. This ſeparate portion is ſometimes large enough to be taken for a diſtinct muſcle, in which caſe we have a quadriceps inſtead of a triceps.

401. In all this progreſs this muſcle is joined to the vaſtus internus by a perforated aponeuroſis, through which the blood-veſſels paſs.

§ 10. *Pyriformis ſive Pyramidalis.*

402. This is a ſmall oblong muſcle of the figure of a flat pear or pyramid, from whence it has its name. It is ſituated almoſt tranſverſely between the Os Sacrum and Iſchium, being covered and hid by the firſt two glutæi.

Situation in general.

403. It is fixed to the inferior lateral part of the Os Sacrum, by fleſhy fibres, and to the neighbouring part of the anterior or concave ſide of that bone, by three digitations lying between the anterior holes. It is likewiſe fixed by a ſmall inſertion to the ligamentum ſacro-ſciaticum and edge of the great ſinus of the Os Ilium.

Inſertions.

404. From thence it runs tranſverſely toward the joint of the hip, its fibres contracting in breadth, and ends in a ſmall tendon which is inſerted in the middle of the internal labium of the upper edge of the great trochanter, by two or three branches. The upper part of this tendon receives ſeveral fibres from the glutæus medius, and its lower part is united to the gemellus ſuperior, and tendon of the obturator internus.

405. Sometimes there are two pyriformes ſeparated by the nervus ſciaticus.

§ 11. *Obturator Internus.*

406. This is a flat muſcle almoſt triangular, ſituated in the bottom of the pelvis. It covers the foramen ovale, and almoſt all the inſide of the Os Pubis and Iſchium. It has its name from a Latin verb which ſignifies to fill up, cover, or ſtop.

Situation in general.

407. It is fixed to the internal labium of all the anterior half of the foramen ovale, a little to the neighbouring part of the obturator ligament; and alſo both

Inſertions.

both above and below the foramen. It is likewiſe fixed to the upper half of the inſide of the Os Iſchium from the upper oblique notch in the foramen ovale, to the ſuperior part of the great poſterior ſinus of the Os Ilium, which would be more properly named *ſinus iliacus*, than *ſinus iſchiadicus*.

408. From all this extent the fleſhy fibres contracting in breadth run down below the ſpine of the Iſchium, where they go out of the pelvis through the poſterior notch of the Iſchium. The inſide of the body of this muſcle, or that turned to the cavity of the pelvis, is pretty uniform; but the outſide, or that turned toward the foramen ovale and which touches the bone, has four middle radiated tendons, which uniting at the poſterior notch of the iſchium, run over it from behind forward, as over a pulley, each tendon ſliding in a particular cartilaginous channel deſcribed in the treatiſe of the ſkeleton.

409. Afterwards the four tendons having got out of the pelvis are very ſtrictly united in one large flat tendon, which croſſing over that of the pyriformis, unites with it, having firſt received on each ſide ſome additional fleſhy fibres from the two gemelli.

410. The great tendon ſlides freely in a ſort of membranous vagina formed by theſe muſcles, as ſhall be obſerved hereafter, and is inſerted in the middle of the ſuperior part of the cavity of the great trochanter, adhering cloſely to the capſular ligament of the joint, and being united to the tendons of the glutæus minimus and pyriformis.

§ 12. *Gemelli.*

Situation in general.

411. Theſe are two ſmall, flat, narrow muſcles, ſituated almoſt tranſverſely one above the other, between the tuberoſity of the iſchium and the great trochanter, immediately below the pyriformis, and parted by the tendon of the obturator internus.

412. The ſuperior and ſmalleſt gemellus is fixed to the lower part of the ſpine of the iſchium, to the ſuperior part of the ſmall iſchiatic notch, and to a rough line which runs croſs the outſide of the iſchium beginning from the ſpine, and continued under the acetabulum, where it is bent downward.

413. The inferior and largeſt gemellus is fixed to the ſuperior and back part of the tuberoſity of the iſchium, and to a rough impreſſion which runs croſs the outſide of the iſchium from the lower extremity of the iſchiatic notch, and is bent upward toward the other line, together with which it forms a ſort of irregular ſemicircle.

414. Both theſe muſcles have likewiſe a ſmall inſertion in the inſide of the iſchium, where being united together by a particular membrane, one of them joins the upper ſide, and the other the lower ſide of the obturator internus, a little after it has paſſed over the notch: they incloſe it as in a bag, and continue to be fixed to it by fleſhy fibres all the way to its extremity

415. The ſuperior muſcle terminates wholly with the tendon of the obturator internus; but the inferior being broader, is inſerted likewiſe by fleſhy fibres in the orbicular ligament, and under the tendon of the ſame obturator.

§ 13. *Obturator Externus.*

416. This is a ſmall flat muſcle which fills up the foramen ovale of the Os Innominatum exteriorly, and reaches from thence to the great trochanter of the Os Femoris, behind the neck of that bone. *Situation in general.*

417. It is fixed by fleſhy fibres to the outer or anterior ſide of the Os Pubis, all the way to the foramen ovale, to the edge of that hole, next the ſmall ramus of the iſchium, and a little to the neighbouring parts of the obturator ligament. *Inſertions.*

418. From thence its fibres contracting in breadth, paſs on the foreſide of the great ramus of the iſchium, under the acetubulum, where a tendon is formed, which continues its courſe behind the neck of the Os Femoris toward the great trochanter, and is inſerted between the gemelli and quadratus, in a ſmall foſſula between the apex of the great trochanter, and the baſis of the collum femoris.

§ 14. *Quadratus.*

419. This is a ſmall, flat, fleſhy muſcle, of the figure of

an oblong ſquare, from whence it has its name. *Situation in general.* It is ſituated tranſverſely between the tuberoſity of the iſchium and the great trochanter.

420. It is fixed by one extremity along that obtuſe line which runs from under the acetabulum, toward *Inſertions.* the lower part of the tuberoſity of the iſchium. From thence it runs directly toward the great trochanter, and is inſerted in almoſt all the lower half of the oblong eminence in that apophyſis; but chiefly in the ſmall riſing or tuberoſity in the middle of that eminence.

§ 15. *Muſculus Faſciæ Latæ.*

421. This is a ſmall and pretty long muſcle, *Situation in general.* ſituated a little obliquely upward and downward on the forepart of the hip.

422. It is fixed above to the outſide of the anterior ſuperior ſpine of the Os Ilium, between the inſertions of *Inſertions.* the glutæus medius and ſartorius. From thence its fleſhy fibres run down a little obliquely backward, forming a very flat body, four fingers breadth in length, and two in breadth.

423. This body lies between two laminæ of the faſcia lata, and is inſerted therein by ſhort tendinous fibres, which diſappear at that place where the faſcia adheres to the great trochanter and tendon of the glutæus maximus. We ought by no means therefore to look upon the faſcia as a tendinous expanſion of this muſcle.

ART. XI.

The muſcles which move the bones of the leg on the Os Femoris.

424. TEN muſcles are commonly reckoned to belong to this article. Moſt of them are very long, and ſituated lengthwiſe near each other, quite round the Os Femoris.

1. *Rectus Anterior ſive Gracilis Anterior.*
2. *Vaſtus Externus.*
3. *Vaſtus Internus.*

4. *Crureus.*
5. *Sartorius.*
6. *Gracilis Internus ſive Rectus Internus.*
7. *Biceps.*
8. *Semi-nervoſus.*
9. *Semi membranoſus.*
10. *Popliteus.*

425. Of theſe ten muſcles the popliteus only is ſmall, and lies as it were out of the rank of the reſt, being ſituated below the thigh. One portion of the biceps is likewiſe ſmall.

426. Theſe muſcles not only move the leg upon the thigh, but alſo the thigh upon the leg, the popliteus excepted. Some of them likewiſe move the thigh upon the pelvis, and the pelvis upon the thigh, viz. the gracilis anterior, ſartorius, gracilis, interior, the great portion of the biceps, ſeminervoſus, and ſemi-membranoſus.

427. Theſe are not the only muſcles which move the leg upon the thigh, and the thigh upon the leg. The gaſtroenemii may likewiſe perform theſe motions, though commonly confined to the extenſion of the foot.

§ 1. *Rectus Anterior ſive Gracilis Anterior.*

Situation in general.

428. This muſcle is as long as the Os Femoris, and lies directly along the foreſide of the thigh, from whence it has the name of *rectus anterior*. The greateſt part of it is fleſhy, and the middle is broader than the two extremities. It is called *gracilis*, from it thinneſs or flatneſs.

Inſertions.

429. It terminates above by a pretty ſtrong tendon which is divided into two branches, one ſhort and ſtraight, the other long and bent. The ſhort branch running up in a ſtraight line is inſerted in the anterior inferior ſpine of the Os Ilium.

430. The long branch is inflected backward over the ſupercilium of the acetabulum, and runs in the direction thereof from the ſpine toward the great iſchiatic ſinus. It is ſtrong and flat, adhering very cloſely to the bone, and covered by the orbicular ligament and the glutæus minimus ; and therefore they who follow the common method in diſſecting, often cut it off, and obſerve only the ſmall branch of the tendon.

431. From thence the muſcle runs down wholly fleſhy and

partly penniform, ſome of its fibres meeting above and ſeparating below. It is narrow at the upper extremity, and grows gradually broader toward the middle. Afterwards it contracts again in the ſame manner, and at the lower extremity of the Os Femoris ends in a flat broad tendon.

432. Through its whole courſe it lies between the two vaſti, and covers the crureus; and its inferior tendon is inſerted in the upper edge of the patella, from whence it ſends down a ſmall plane of tendinous fibres which adhere very cloſely to the convex ſide of that bone, and having reached the great ligament, ſeem to be loſt therein.

§ 2. *Vaſtus Externus.*

Situation in general.

433. This is a very large fleſhy muſcle, almoſt as long as the Os Femoris, broad at the extremities and thick in the middle, lying on the outſide of the thigh.

Inſertions.

434. Its upper inſertion being ſomething tendinous, is in the poſterior or convex rough ſurface of the great trochanter. It is likewiſe fixed by a fleſhy inſertion along the outſide of the Os Femoris for above two thirds of its length downward, in the correſponding part of the linea aſpera, and in the neighbouring portion of the faſcia lata.

435. From all this extent the fleſhy fibres running downward, and a little obliquely forward toward the rectus anterior, terminate inſenſibly in a kind of ſhort aponeuroſis, which is fixed in all the neareſt edge of the tendon of the rectus, in the ſide of the patella, in the edge of the ligament of that bone, and in the neighbouring lateral part of the head of the tibia.

436. The body or belly of this muſcle grows bigger gradually from its upper extremity to the middle, and from thence diminiſhes again by degrees. Its loweſt fibres run in a little behind the rectus, and are inſerted there.

§ 3. *Vaſtus Internus.*

Situation in general.

437. This muſcle is very like the former, and ſituated in the ſame manner on the inſide of the Os Femoris.

438. It is fixed above by a ſhort flat tendon, in the anterior rough ſurface of the great trochanter, and by fleſhy fibres in that oblique line which terminates the baſis of the collum femoris anteriorly, on the foreſide of the inſertions of the pſoas and iliacus; in the whole inſide of the Os Femoris, and in the linea aſpera on one ſide of the inſertions of the three tricipites, almoſt down to the internal condyle. *Inſertions.*

439. From all this extent the fibres run downward, and a little obliquely forward, and the body of the muſcle increaſes in the ſame manner as the vaſtus internus. It terminates below in the aponeuroſis, which is fixed in the edge of the tendon of the rectus anterior, in the ſide of the patella, and of its tendinous ligament, and in the ſide of the head or upper extremity of the tibia.

§ 4. *Crureus.*

440. This is a fleſhy maſs, covering almoſt all the foreſide of the Os Femoris, between the two vaſti, which likewiſe cover the edges of this muſcle on each ſide. *Situation in general.*

441. It is fixed to the foreſide of the Os Femoris, from the anterior ſurface of the great trochanter down to the loweſt quarter of the bone, by fleſhy fibres which run down ſucceſſively over each other, between the two vaſti, and are partly united to theſe two muſcles, ſo as not to ſeem to form a diſtinct muſcle. *Inſertions.*

442. It is not ſo thick as the two vaſti; and as it is covered by them on each ſide, a ſort of fleſhy channel is formed by all the three, in which the rectus is lodged, covering the forepart of the crureus.

443. It terminates below in a tendinous aponeuroſis, which joins the backſide of the tendon of the rectus anterior, and the neighbouring edges of the extremities of the two vaſti. Thus theſe four muſcles form a common tendon, which is inſerted in the places already mentioned.

§ 5. *Sartorius.*

Situation in general. 444. This is the longeſt muſcle of the human body. It is flat, and about two fingers in breadth, ſituated obliquely along the inſide of the thigh. It is called *ſartorius*, for a reaſon which ſhall be given in deſcribing its uſes.

Inſertions. 445. It is fixed above by a very ſhort tendon, in the lower part of the anterior ſuperior ſpine of the Os Ilium, before the muſculus faſciæ latæ The beginning of its body lies in the notch between the two anterior ſpines of that bone.

446. From thence it runs down obliquely over the vaſtus internus and other muſcles that lie near it, all the way to the inſide of the knee, where it terminates in a ſmall tendon which grows broader near its extremity, and is inſerted obliquely and a little tranſverſely, in the forepart of the inſide of the head of the tibia, near the ſpine or tuberoſity of that bone, immediately above the inſertion of the gracilis interior.

447. The fleſhy body of this muſcle is incloſed in a vagina formed by an expanſion of the faſcia lata. Its fibres in general are longitudinal, and where its lower tendon turns obliquely round toward the head of the tibia, it ſeems to be braced down and ſecured in its place, by a tendinous frænum or vagina. A little before it is inſerted, it detaches a diſtinct aponeuroſis or tendinous branch, which runs obliquely downward on the inſide of the tibia.

§ 6. *Gracilis Interior ſive Rectus Interior.*

Situation in general. 448. This is a long thin muſcle lying in a ſtraight line on the inſide of the thigh, between the Os Pubis and the knee; and from this ſituation and ſtructure its names are taken.

Inſertions. 449. It is fixed in the edge of the inferior branch of the Os Pubis near the ſymphyſis, by a broad and very ſhort tendon, on one ſide of the inſertion of the triceps ſecundus, but a little lower down.

450. From thence the fleſhy fibres contracting a little in breadth, run down to the internal condyle of the Os Femoris,

ris, where they terminate in a thin tendon, which afterwards degenerates into a kind of aponeuroſis, and is inſerted in the forepart of the inſide of the head of the tibia.

451. This tendon is inſerted immediately below the ſartorius, by which it is partly covered, and above the ſemi-tendinoſus, which it partly covers, mixing ſome fibres with it. Before it ends, it makes the ſame oblique turn, and is braced down in the ſame manner as the tendon of the ſartorius, and it ſends the ſame kind of aponeuroſis obliquely downward on the inſide of the tibia.

§ 7. *Biceps.*

452. This muſcle is made up of two portions, one long the other ſhort, and they end in a common tendon. Both portions are fleſhy and conſiderably thick, being ſituated on the back and ouſide of the thigh between the buttock and ham. *Situation in general.*

453. The great portion is fixed above by a ſtrong tendon in the poſterior and lower part of the tuberoſity of the iſchium under the inſertion of the inferior gemellus, and cloſe behind that of the ſemi-nervoſus. From thence it runs down toward the lower extremity of the thigh, where it meets the other portion, and joins with it in forming a common tendon.

454. The ſmall portion is fixed by fleſhy fibres to the outſide of the linea aſpera below its middle, and to the faſcia lata where it forms a ſeptum between the triceps and vaſtus externus. From thence the fibres run down a little way, and then meeting the great portion, a common tendon is formed between them.

455. This ſtrong tendon runs down to the outer and back part of the knee, and is inſerted in the lateral ligament of the joint and in the head of the fibula by two very ſhort tendinous branches. It ſometimes ſends off a tendinous expanſion, which is often unſkillfully cut off with the fat.

§ 8. *Semi-Nervoſus.*

456. This is a long muſcle half fleſhy and half tendinous, or like a nerve, from whence *Situation in general.*

it has its name. It is ſituated a little obliquely on the poſterior and inner part of the thigh.

Inſertions,

457. It is fixed above to the poſterior part of the tuberoſity of the iſchium, immediately before and a little more inward than the biceps. It is afterwards fixed by fleſhy fibres to the tendon of the biceps for about the breadth of three fingers, much in the ſame manner as the coraco-brachialis is fixed to the biceps of the arm.

458. From thence it runs down fleſhy toward the lower part of the inſide of the thigh, having a ſort of tendinous interſection in the inner part of its fleſhy portion. Having reached below the middle of the thigh, it terminates in a ſmall, long, round tendon, which runs down to the inſide of the knee behind that of the gracilis, where it expands in breadth.

459. It is inſerted in the inſide of the upper part of the tibia about two or three fingers breadth below the tuberoſity or ſpine, immediately under the tendon of the gracilis internus with which it communicates. It has the ſame oblique turn with the gracilis and ſartorius, and ſends off a like kind of aponeuroſis.

§ 9. *Semi-Membranoſus.*

Situation in general.

460. This is a long thin muſcle, partly tendinous, from whence it has its name, and ſituated on the backſide of the thigh a little towards the inſide.

Inſertions.

461. It is fixed above by a broad tendon or long aponeuroſis in the irregular obtuſe, prominent line which goes from the acetabulum to the tuberoſity of the iſchium, a little above the inſertion of the ſemi-nervoſus, and between thoſe of the gemellus inferior and quadratus, mixing ſome fibres with the triceps tertius.

462. From thence it runs down fleſhy in an oblique direction behind the inner condyle of the Os Femoris, below which it terminates in a thick tendon, which is inſerted in the poſterior and interior ſide of the inner condyle of the tibia, by three ſhort branches, the firſt or uppermoſt of which goes a little toward the inſide, the ſecond, more backward,

and the third, lower down. Before it is inſerted, it ſends off ſometimes an aponeuroſis like that of the biceps.

§ 10. *Popliteus.*

Situation in general.

463. This is a ſmall muſcle, obliquely pyramidal, ſituated under the ham, from whence it has its name.

Inſertions.

464. It is fixed above by a ſtrong narrow tendon to the outer edge of the inner condyle of the Os Femoris, and to the neighbouring poſterior ligament of the joint. From thence it runs obliquely downward under the inner condyle of the Os Femoris; its flat and pretty thick fleſhy body increaſing gradually in breadth, till it is fixed in the backſide of the head of the tibia all the way to the oblique line or impreſſion obſervable on that ſide.

A R T. XII.

The muſcles which move the tarſus on the leg.

465. THE motions of the tarſus are ſuppoſed to be performed by nine muſcles ſituated in the leg; three on the foreſide, and ſix on the backſide, *viz.*

1. *Tibialis Anticus.*
2. *Peronæus Medius.*
3. *Peronæus Minimus.*
4. 5. *Gaſtrocnemii.*
6. *Soleus.*
7. *Tibialis Gracilis vulgo Plantaris.*
8. *Tibialis Poſticus.*
9. *Peronæus Maximus.*

466. Theſe muſcles, three of which are anterior and ſix poſterior, not only move the tarſus on the leg, but alſo the leg on the tarſus, except the tibialis gracilis or plantaris. Theſe motions may likewiſe be performed by four muſcles which belong to the toes, the names of which are theſe:

10. *Extenſor Pollicis Longus.*
11. *Extenſor Digitorum Longus.*
12. *Flexor Pollicis Longus.*
13. *Flexor Digitorum Longus.*

§ 1. *Tibialis Anticus.*

467. This is a long muſcle, fleſhy at the upper part, and

Situation in general tendinous at the lower, ſituated on the foreſide of the leg between the tibia and the extenſor digitorum longus.

468. It is fixed above by fleſhy fibres in the upper third *Inſertions.* part of the external labium of the criſta tibiæ, and of the inſide of the aponeuroſis tibialis, or of that ligamentary expanſion which goes between the criſta tibiæ and the anterior angle of the fibula. It is likewiſe fixed obliquely in the upper two thirds of the outſide of the tibia, or that next the fibula.

469. From thence it runs down, and ends in a tendon, which firſt paſſes through a ring of the common annular ligament, and then through another ſeparate ring ſituated lower down. Afterwards the tendon is fixed partly in the upper and inner part of the Os Cuboides, and partly in the inſide of the firſt bone of the metatarſus.

§ 2. *Peronæus Medius vulgo Peronæus Anticus.*

Situation in general. 470. This is a long muſcle, ſituated anteriorly on the middle part of the fibula.

471. It is fixed above by fleſhy fibres, to more than the *Inſertions.* middle third part of the anterior or outſide of the fibula, and to the neighbouring part of the aponeuroſis tibialis.

472. It is likewiſe fixed to a production from the inſide of that aponeuroſis which runs to the upper part of the tibia, and there ſerves for a middle ſeptum between this muſcle and the extenſor digitorum longus.

473. From thence it runs down and forms a tendon, which going in the direction of the oblique line on the fibula, paſſes behind the external melleolus, and then through an annular ligament common to it and to the peronæus maximus, and is afterwards inſerted in the tuberoſity at the baſis of the fifth metatarſal bone, ſending off a ſmall tendon to the firſt phalanx of the little toe.

§ 3. *Peronæus Minimus.*

Situation in general. 474. This is a ſmall muſcle, commonly thought to be a portion of the extenſor digitorum longus, though it is eaſily ſeparable from it.

475. It is fixed by fleſhy fibres in the lower half of the inſide of the fibula, between two oblique bony lines, on one ſide of the lower part of the extenſor digitorum longus, to which muſcle it is ſimply contiguous. *Inſertions.*

476. From thence it runs down, contracting in breadth, and paſſes with the extenſor longus through the common annular ligament forming a flat tendon, which ſoon ſeparates from thoſe of the extenſor, and is inſerted near the baſis of the fifth metatarſal bone.

477. It is diſtinguiſhed from the other two peronæi by a ſeptum or production of the ligamentary aponeuroſis of the tibia.

§ 4. *Gaſtrocnemii.*

478. Theſe are two thick, pretty broad and oblong muſcles, ſituated laterally with reſpect to each other in the ſame plane, under the poples, and forming a great part of what is called *the calf of the leg*. That which lies next the tibia is called *internus*, and that next the fibula, *externus*; and becauſe they form, as it were, the belly of the leg, they have been termed in Greek, *gaſtrocnemii*. *Situation in general.*

479. Each muſcle is fixed above by a flat tendon, to the poſterior part of the lower extremity of the Os Femoris, behind the lateral tuberoſity of each condyle, adhering cloſely to the poſterior ligaments of the joint of the knee. *Inſertions.*

480. From thence they run down, each forming a large and pretty broad fleſhy body, irregularly oval. The externus covers the popliteus, being larger and broader, ſpreading more laterally, and running lower down than the internus, the fleſhy body of which begins higher up than the other.

481. About the middle of the leg they end in a ſtrong, broad, common tendon, which contracts a little in breadth as it deſcends, and is inſerted in the poſterior extremity of the Os Calcis, together with the tendon of the ſoleus.

482. The ſuperior tendons of theſe muſcles, become gradually cartilaginous in aged perſons, and at laſt oſſify near the condyles; the bony portions looking like ſeſamoide bones,

It is ſometimes very late before they are hardened in this manner, and ſometimes one grows hard before the other.

§ 5. *Soleus.*

483. This is a large, fleſhy, flat muſcle, nearly of an oval figure, and thicker in the middle than at the edges. It has its name from its ſuppoſed likeneſs to a ſole. It is ſituated on the backſide of the leg, lower down than the gaſtrocnemii by which it is covered, and theſe three muſcles form the calf of the leg.

Situation in general.

484. It is fixed above, partly to the tibia and partly to the fibula. It is fixed to above one third of the upper part of the backſide of the fibula, and a little to the articular ligament of the head of this bone. It is likewiſe fixed to the backſide of the tibia from the oblique line or impreſſion which terminates the inſertion of the popliteus, down to the middle of the internal angle of the bone.

Inſertions.

485. Afterwards leaving theſe two bones it ends in a broad ſtrong tendon, which, together with that of the gaſtrocnemii, forms what is called *tendo Achillis*. This ſtrong tendon contracts a little in its paſſage to the Os Calcis, and then expanding a little, it is inſerted obliquely in the backſide of that bone all the way to the tuberoſity. The outer or poſterior fibres of this large tendon are the longeſt, the inner or anterior fibres ſhorteſt, and the reſt are longer or ſhorter in proportion to their nearneſs to theſe two portions.

486. The fleſhy body of the ſoleus ſeems to conſiſt of two planes of fibres at leaſt, that on the backſide of the muſcle being the moſt ſimple; and the other, or that next the bone, being penniform.

487. This muſcle and the two gaſtrocnemii form what anatomiſts call *a true triceps*.

§ 6. *Tibialis Gracilis vulgo Plantaris.*

488. This is a ſmall pyriform muſcle, ſituated obliquely in the ham below the external condyle of the Os Femoris, between the popliteus and gaſtrocnemius externus; and its tendon, which is long, flat,

Situation in general.

flat, and very ſmall, runs down on the ſide of the gaſtrocnemius internus all the way to the heel.

489. The fleſhy body, which is only about two inches in length and one in breadth, is fixed by a ſhort flat tendon above the outer edge of the exterior condyle of the Os Femoris, on one ſide of the gaſtrocnemius externus. From thence the fleſhy body runs obliquely over the edge of the popliteus, and terminates in a very ſmall, long, flat tendon. *Inſertions.*

490. This tendon runs between the body of the gaſtrocnemius externus and ſoleus, all the way to the inner edge of the upper part of the tendo Achillis; and from thence continuing its courſe downward, it joins this tendon, and is inſerted, together with it, in the outſide of the poſterior part of the Os Calcis, without communicating with the aponeuroſis plantaris.

491. Sometimes this muſcle is wanting, and ſometimes it is ſituated lower down.

§ 7. *Tibialis Poſticus.*

492. This is a long fleſhy penniform muſcle, broader above than below, ſituated between the tibia and fibula, on the backſide of the leg, and covered by the extenſor digitorum longus. *Situation in general.*

493. It is fixed above by fleſhy fibres, immediately under the articulation of the tibia and fibula, to the neareſt parts of theſe two bones, chiefly to the tibia, reaching to the lateral parts of that bone, above the interoſſeous ligament which is here wanting. *Inſertions.*

494. From thence its inſertion is extended below the oblique line or impreſſion in the tibia, over all the neighbouring part of the interoſſeous ligament, and through more than the upper half of the internal angle of the fibula.

495. Through all this ſpace it is fleſhy, penniform, and covered by the extenſor digitorum longus, which ſometimes communicates with it by a middle tendon, and ſends off an aponeuroſis to it, which does the office of a frænum.

496. After this, it forms a tendon which runs down behind the inner malleolus, through a cartilaginous groove and an annular ligament, and paſſing under the malleolus, is inſerted in the tuberoſity or lower part of the Os Scaphoides.

This tendon is ſometimes divided into two, one of which croſſing a little over that of the peronæus longus is fixed in the Os Cuboides.

§ 8. *Peronæus Maximus vulgo Peronæus Poſterior.*

Situation in general. 497. This is a long penniform muſcle lying on the fibula.

498. It is fixed above to the anterior and outer part of the head of the fibula, and to a ſmall portion of the head of the tibia; then to the outſide of the neck of the fibula, to the upper half of the external angle of that bone, and to the aponeuroſis tibialis, which at that place makes a ſeptum between this muſcle and the extenſor pollicis. *Inſertions.*

499. From thence turning a little backward according to the direction of the bone, it forms a conſiderable tendon, which running down behind the external malleolus, paſſes through a kind of hollow groove, and through an annular ligament common to it, and to the tendon of the peronæus medius which lies before it. It paſſes likewiſe through an annular ligament on the outer and anterior part of the Os Calcis, and under the ſmall lateral tuberoſity ſometimes found there.

500. Afterwards running through the oblique groove in the lower ſide of the Os Cuboides, it is inſerted in the ſide of the baſis of the firſt metatarſal bone, and alſo a little in the baſis of the Os Cuneiforme majus.

501. The fleſhy body of this muſcle cannot always be diſtinguiſhed from that of the peronæus medius.

ART. XIII.

The Muſcles which move the metatarſus and toes.

§ 1. *Extenſor Pollicis Longus.*

Situation in general. 502. THIS is a thin ſingle muſcle lying between the tibialis anticus and extenſor digitorum longus, by which it is almoſt hid.

503. It is fixed to the inſide of the fibula near the interoſſeous ligament, from the neck, down to the loweſt quarter of that bone; to the interoſſeous ligament *Inſertions.*

through the ſame ſpace, and a little to the lower extremity of the tibia next the fibula.

504. There it ends in a conſiderable tendon, which paſſing through a diſtinct ring of the common annular ligament, and then through a membranous vagina, is inſerted in the baſis of the firſt phalanx of the great toe, and continued from thence up to the ſecond.

§ 2. *Flexor Pollicis Longus.*

505. This is a pretty long muſcle ſituated in the poſterior and lower part of the leg. *Situation in general.*

506. It is fixed in the lower half of the backſide of the fibula, its inſertion reaching almoſt as far as the external malleolus. The fleſhy body advances on the inſide of that bone towards the tibia, according to the oblique direction of that ſide, and ends in a large tendon. *Inſertions.*

507. This tendon paſſes behind the lower extremity of the tibia, toward the inner ancle, then through a ſmall notch in the inner and backſide of the aſtragalus, and through an annular ligament or ligamentary vagina continued under the lateral arch of the Os Calcis.

508. From thence it advances to the great toe, and paſſing through the interſtice between the two ſeſamoide bones, in the ligamentary vagina of the firſt phalanx, is inſerted in the lower part of the ſecond. In ſome ſubjects, this vagina is almoſt cartilaginous.

509. The two ſeſamoide bones are ſtrongly connected together by ligaments, and alſo to the lower edge of the firſt phalanx, in ſuch a manner as to ſlide eaſily on the two inferior depreſſions or double pulley of the head of the firſt metatarſal bone. The ligament by which they are fixed to the firſt phalanx is very thick, and has the appearance of a cartilage as much as the vagina.

§ 3. *Thenar.*

510. This muſcle is made up of ſeveral portions, and lies on the inner edge of the ſole of the foot. *Situation in general.*

511. It is fixed by three or four fleſhy faſciculi to the lower and inner part of the Os Calcis, Os Scaphoides, and Os Cuneiforme majus. It is likewiſe fixed a little in the annular ligament under the inner ancle, which belongs to the tendon of the flexor longus. *Inſertions.*

512. From all theſe different inſertions the fleſhy faſciculi approach each other as they advance forward under the firſt bone of the metatarſus, and are fixed partly in the internal ſeſamoide bone, and partly in the inſide of the firſt phalanx near its baſis.

513. There is another faſciculus fixed by one end to the Os Scaphoides and Os Cuneiforme majus, and by the other to the external ſeſamoide bone, and outſide of the firſt phalanx of the great toe.

§ 4. *Antithenar.*

Situation in general. 514. This is a ſmall compound muſcle, lying obliquely under the metatarſal bones.

515. It is fixed poſteriorly in the lower parts of the ſecond, third and fourth metatarſal bones near their baſes; in the ligament belonging to the firſt and ſecond of theſe bones; in the neighbouring ligaments belonging to the bones of the tarſus; and laſtly, in a lateral aponeuroſis of the muſcle commonly called *hypothenar*. *Inſertions.*

516. All theſe portions contracting into a ſmall compaſs, are inſerted in the outſide of the external ſeſamoide bone, and of the firſt phalanx of the great toe.

§ 5. *Extenſor Digitorum Longus.*

Situation in general. 517. This is a long muſcle, fleſhy in the upper part, and tendinous in the lower, lying between the tibialis anticus and peronæus maximus.

518. It is fixed above by fleſhy fibres in the outſide of the head of the tibia, and inſide of the head of the fibula; in the upper part of the interoſſeus ligament, through three fourths of the length of the fibula; and through the ſame ſpace, in the tendinous ſeptum belonging to the anterior angle of that bone. *Inſertions.*

519. It ſeems to mix ſome fibres on each ſide with the two

firſt peronæi and tibialis anticus; and it is very cloſely united with the peronæus minimus, which has for that reaſon been looked upon as a portion of this extenſor.

520. It contracts in breadth a little above the aunular ligament, and in paſſing through it, is divided into three tendons, the firſt of which is afterwards divided into two. Theſe four tendons are inſerted along the upper or convex ſide of the four ſmall toes.

§ 6. *Extenſor Digitorum Brevis.*

521. This is a ſmall complex muſcle lying obliquely on the convex ſide of the foot, being likewiſe termed *pedieus*. *Situation in general.*

522. It is fixed in the upper and outer ſide of the anterior apophyſis of the aſtragalus, and in the neighbouring part of the upper ſide of that bone. From thence it runs obliquely from without inwards, under the tendons of the peronæus minimus and extenſor digitorum longus, being divided into four fleſhy portions which terminate in the ſame number of tendons. *Inſertions.*

523. The firſt tendon is inſerted in the upper or convex part of the firſt phalanx of the great toe. The other three joining with thoſe of the extenſor longus are inſerted along the convex ſides of all the phalanges of the three following toes; and when there is a fifth tendon, which happens very ſeldom, it goes in the ſame manner to the little toe.

524. As this muſcle is ſituated obliquely, its tendons and thoſe of the extenſor longus croſs each other a little; and after their common inſertion in the firſt phalanges of the toes, thoſe of the ſhort extenſor run along the two other phalanges, almoſt on the outſide of the others. All theſe tendons communicate by aponeuroſes in the ſame manner as thoſe of the hand.

§ 7. *Flexor Digitorum Brevis ſive Perforatus Pedis.*

525. This is the undermoſt of all the common muſcles of the toes, being ſituated immediately above the aponeuroſis plantaris, which it reſembles ſomething in figure; and hence we ſee that it has been very improperly termed *ſublimis*. *Situation in general.*

526. It is fixed by fleſhy fibres to the anterior and lower *Inſertions.* part of the great tuberoſity of the Os Calcis; and to the neighbouring part of the upper ſide of the aponeuroſis plantaris.

527. From thence it runs forward, being divided into four fleſhy portions, which terminate in the ſame number of tendons, ſplit at their extremites in the ſame manner as thoſe of the ſublimis or perforatus of the hand, and inſerted in the ſecond phalanges of the four ſmall toes, a little nearer the inſide than in the hand.

§ 8. *Flexor Digitorum Longus ſive Perforans Pedis.*

Situation in general. 528. This is a long muſcle, fleſhy above and tendinous below, lying on the backſide of the leg between the tibia and the flexor pollicis longus, covered by the ſoleus, and covering the tibialis poſticus.

529. It is fixed above by fleſhy fibres to a little more than the *Inſertions.* middle third part of the backſide of the tibia near its external angle, below the inſertion of the ſoleus; and alſo to a kind of ligament which runs down from the middle of the tibia. It afterwards ends in a tendon which paſſes behind the inner ancle, on one ſide, and a little behind the tibialis poſticus, in a ſeparate annular ligament.

530 From thence it runs under the ſole of the foot, ſending off a detachment, by which it communicates with the flexor pollicis longus. There it is divided into four ſmall flat tendons, which go to the third phalanges of the four ſmall toes in the ſame manner as the perforans of the hand.

531. Theſe four tendons agree likewiſe in this with thoſe of the hand, that they give inſertions to the lumbricales; but they differ from them in this, that before their ſeparation they are joined laterally by an auxiliary fleſhy body, which I name *flexor digitorum acceſſorius.*

§ 9. *Flexor Digitorum Acceſſorius.*

Situation in general. 532. This is a flat and pretty long fleſhy maſs, ſituated obliquely under the ſole of the foot, which from its ſituation and figure was formerly termed *caro plantæ pedis quadrata.*

533. This muſcle is fixed poſteriorly by one fleſhy portion, in the lower ſide of the Os Calcis, and in the anterior tuberoſity on that ſide, and by the other in the neighbouring ligament which joins this bone to the aſtragalus. *Inſertions.*

534. From thence the two portions run obliquely to the middle of the ſole of the foot, and there unite in a flat long and irregularly ſquare muſcular maſs, which is fixed to the outer edge of the faſciculus of the tendons of the flector longus, to which it ſerves as a frænum at that place.

535. This muſcle might more properly be named *plantaris*, than that which is commonly ſo called, to which I have given the name of *tibialis gracilis*.

§ 10. *Lumbricales.*

536. Theſe are four ſmall muſcles, ſituated more or leſs longitudinally under the ſole of the foot. *Situation in general.*

537. They are fixed by their fleſhy extremities to the four tendons of the flexor digitorum longus near the inſertion of the flexor acceſſorius. The firſt muſcle is fixed to the inſide of the firſt tendon; the ſecond, to the tendinous fork formed by the two firſt tendons; the third, to the tendinous fork made by the ſecond and third tendons; and the fourth, in the ſame manner to the third and fourth tendons, but commonly moſt to the third. *Inſertions.*

538. From thence theſe four muſcles run to the toes, and there terminate in the ſame number of ſmall tendons which are inſerted in the firſt phalanges of the toes much after the ſame manner as in the hand. They are termed *lumbricales* or *vermiculares*, becauſe of the reſemblance they bear to worms.

§ 11. *Tranſverſalis Digitorum.*

539. This is a ſmall muſcle which lies tranſverſely under the baſis of the firſt phalanges, and which at firſt ſight appears to be a ſimple muſcular body fixed by one end to the great toe, and by the other to the little toe. *Situation in general.*

540. When this muſcle is carefully examined, we find that

it is fixed by a very ſhort common tendon to the *Inſertions.* outſide of the baſis of the firſt phalanx of the great toe, conjointly with the antithenar; and by three different portions or digitations, to the three interoſſeous ligaments which connect the heads of the four metatarſal bones next the great toe, laterally to each other. Theſe three portions are very ſlender, and gradually cover each other.

541. This muſcle might be reckoned a ſecond antithenar.

§ 12. *Interoſſei.*

542. Theſe are ſeven ſmall muſcles which fill *Situation in general.* up the four interſtices between the metatarſal bones, much after the ſame manner as in the hand, The four largeſt are ſuperior, the other three inferior. The common diviſion of them into external and internal is very improper.

543. The firſt of the ſuperior muſcles is fixed poſteriorly by fleſhy fibres, in the ligament which connects the *Inſertions.* baſis of the two firſt metatarſal bones; in the outſide of the firſt bone, and in the upper part of the inſide of the ſecond. It ends in a ſmall tendon, which is inſerted in the inſide of the firſt phalanx of the ſecond toe.

544. The other three are fixed by fleſhy fibres in the inner and upper parts of the laſt three metatarſal bones, and in the outer and upper parts of the ſecond, third, and fourth bones. They likewiſe end in tendons which are inſerted in the outſides of the firſt phalanges of the ſecond, third, and fourth toes.

545. The three inferior muſcles are fixed proportionably by fleſhy fibres to the lower parts of theſe bones, chiefly to the third, fourth, and fifth, and to the ligaments belonging to their baſis. The firſt inferior interoſſeous is likewiſe fixed by ſome fibres to the tendon of the peronæus maximus. The tendons of theſe three muſcles are inſerted in the inſides of the baſes of the firſt phalanges of the laſt three toes.

§ 13. *Metatarſius.*

546. This is a fleſhy maſs lying under the ſole of the foot. It is fixed by one end, in the forepart of the great tuberoſi-

ty of the Os Calcis; and running forward from thence, it terminates in a kind of ſhort tendon which is fixed in the tuberoſity and poſterior part of the lower ſide of the fifth bone of the metatarſus. It may move this bone much after the ſame manner as the metacarpius moves the fourth bone of the metacarpus.

§ 14, *Parathenar Major.*

547. This is a pretty long muſcle, forming part of the outer edge of the ſole of the foot. It is commonly termed *hypothenar*, but very improperly, according to the ſignification of that word. *Situation.*

548. It is fixed backwards, by a fleſhy body, to the outer part of the lower ſide of the Os Calcis, from the ſmall poſterior external tuberoſity all the way to the anterior tuberoſity. There it joins the metatarſius, and at the baſis of the fifth metatarſal bone, ſeparates from it again, and forms a tendon which is inſerted in the outſide of the firſt phalanx of the little toe near its baſis, and near the inſertion of the parathenar minor. *Inſertions.*

§ 15. *Parathenar Minor.*

549. This is a fleſhy muſcle fixed along the poſterior half of the outer and lower ſide of the fifth bone of the metatarſus. It terminates under the head of that bone, in a tendon which is inſerted in the lower part of the baſis of the firſt phalanx of the little toe.

550. The tendinous inſertion of this muſcle is very cloſely united to the cartilaginous ligament mentioned in the deſcription of the freſh bones. The ſame thing is to be obſerved concerning the other muſcles which go to the lower parts of the baſis of the firſt and ſecond phalanges of the toes. In aged perſons ſome parts of theſe ligaments are often turned to bone, and thereby form theſe bony portions which are taken diſtinct for ſeſamoide bones, as has been already ſaid.

ART.

ART. XIII.

The muſcles employed in reſpiration.

551. I Reduce theſe muſcles to a ſmaller number than is commonly done, *viz.*

1. *Diaphragma.*
2. *Scaleni.*
3. *Serrati Poſtici Superiores.*
4. *Serrati Poſtici inferiores.*
5. *Inter-coſtales.*
6. *Supra-coſtales.*
7. *Infra-coſtales.*
8. *Sterno-coſtales vulgo Triangulares.*

552. The diaphragm is one muſcle in a middle ſituation in the body. All the reſt are regularly diſpoſed in pairs on the two ſides of the thorax, and ſeveral of them are in great numbers. The ſubclavii and ſacro-lumbares are commonly joined to theſe muſcles, and ſome anatomiſts add the pectorales minores, and ſerrati majores. I have already ranked the ſubclavii pectorales minores, and ſerrati majores, among the muſcles that move the ſhoulders; and I place the ſacro-lumbares among thoſe that perform the particular motions of the back.

§ 1. *Diaphragma.*

Situation in general and figure.

553. This is a very broad and thin muſcle, ſituated at the baſis of the thorax, and ſerving as a tranſverſe partition to ſeparate that cavity from the abdomen. For this reaſon the Greeks termed it *diaphragma*, and the Latins, *ſeptum tranſverſum.* It forms an oblique inclined arch, the forepart of which is higheſt, and the poſterior part loweſt, making a very acute angle with the back.

Diviſion.

554. It is looked upon as a double and digaſtric muſcle, made up of two different portions, one large and ſuperior, called *the great muſcle of the diaphragm*; the other ſmall and inferior, appearing like an appendix to the other, called *the ſmall* or *inferior muſcle of the diaphragm.*

555. The great or principal muſcle is fleſhy in its circumference,

ference, and tendinous and aponeurotic in the middle, which, for that reaſon, is commonly called *centrum nervum ſive tendinoſum.* It muſt not however be imagined that this middle part is of ſmall extent, or that it is round, becauſe anatomiſts have named it *the centre*; for, in ſo doing, they had regard only to its ſituation, not to its form, or to the ſpace it takes up. It is of a conſiderable breadth, and repreſents in ſome meaſure a trefoil leaf, ſuppoſing the part to which the footſtalk is fixed to be ſloped, and that this ſlope is turned backward, and the middle convex part forward; and therefore, in the public courſes which I gave at the royal garden for the ſpace of twelve years, I choſe to call it ſimply *the middle aponeuroſis* or *aponeurotic plane of the diaphragm.*

Inſertions.

556. The fleſhy circumference is radiated, the fibres of which it is made up, being fixed by one extremity to the edge of the middle aponeuroſis, and by the other to all the baſis of the cavity of the thorax, being inſerted by digitations in the lower parts of the appendix of the ſternum, of the loweſt true ribs, of all the falſe ribs, and in the neighbouring vertebræ.

557. We have therefore three kinds of inſertions, one ſternal, twelve coſtal, ſix on each ſide, and two vertebral, one on each ſide. Theſe laſt are very ſmall, and ſometimes ſcarcely perceivable. The coſtal inſertions join thoſe of the tranſverſalis abdominis, but do not mix with them, as they ſeem to do, before the membrane which covers them is removed. I need not mention here ſome communicating fibres of the ſame nature with thoſe found in other muſcles, as for inſtance, between the obliquus externus and pectoralis major.

558. The fibres inſerted in the appendix enſiformis, run from behind directly forward, and form a ſmall parallel plane. I have ſometimes obſerved a faſciculus of fibres detached from the under ſide of this plane, to run down on the inſide of the linea alba, in which it is inſerted near the umbilicus.

559. The firſt coſtal inſertion runs a little obliquely towards the cartilage of the ſeventh true rib, a triangular ſpace being left between this and the ſternal inſertion, at which the pleura and peritonæum meet, as ſhall be ſaid hereafter. The inſertion of theſe fibres is very broad, taking up about two thirds of the cartilage of the ſeventh rib, and a ſmall part of the

bone, from whence it reaches beyond the angle of the cartilage.

560. The ſecond inſertion is into the whole cartilage of the firſt falſe rib; the third partly in the bone, and partly in the cartilage of the ſecond falſe rib; the fourth in the bone, and ſometimes a little in the cartilage of the third falſe rib; the fifth in the bone and a little in the cartilage of the fourth falſe rib, being broader than the reſt.

561. The ſixth is in the cartilage of the laſt falſe rib, and almoſt through the whole length of the bone. At the head of this rib, it joins the vertebral inſertion which runs from the lateral part of the laſt vertebra of the back, to the firſt vertebra of the loins.

562. Between this vertebral inſertion and the ſecond muſcle of the diaphragm, a ſmall triangular interſtice is ſometimes left like that which I mentioned in ſpeaking of the firſt inſertion. This inſertion and that in the laſt falſe rib, join the upper extremities of the pſoas and triangularis or quadratus lumborum, and ſends off to them ſome communicating fibres. The common plane of theſe laſt inſertions, by the ſeparation of their fibres, form a hole, through which a bundle of nerves paſſes.

563. It is to be obſerved, that the lateral inſertions of the great muſcle of the diaphragm on the right ſide appear to be lower than thoſe on the left ſide; and that the right lateral portion appears to be larger than the left, as being more arched.

564. The ſmall muſcle of the diaphragm is thicker than the other, but of much leſs extent. It is ſituated along the foreſide of the bodies of the laſt vertebra of the back and ſeveral of thoſe of the loins, being turned a little to the left hand. It is of an oblong form, repreſenting in ſome meaſure a fleſhy collar, the two lateral portions of which croſs each other, and afterwards become tendinous toward the lower part.

565. The upper part of the body of this muſcle is fixed in the ſlope of the middle aponeuroſis of the great muſcle. The outer edges of the alæ or lateral portions join the poſterior plane of the great muſcle, and theſe portions adhere to the body of the laſt vertebra of the back. The extremities, called

led likewiſe *pillars* or *crura*, are inſerted by ſeveral tendinous digitations in the vertebræ of the loins.

566. The upper part of the fleſhy body is formed by a particular intertexture of fibres belonging to the two alæ. Theſe two alæ, whereof that toward the right hand is generally the moſt conſiderable, part from each other, and form an oval hole, terminated in the lower part by fibres detached from the inſide of each ala, immediately above the laſt vertebra of the back. Theſe fibres decuſſate and croſs each other, and afterwards thoſe that come from each ala, join that on the other ſide, ſo that each of the crura is a production of both alæ.

567. The fibres that come from the left ala, croſs over thoſe from the right ala, and this again ſends a ſmall faſciculus of fibres over thoſe of the left ala; afterwards the two crura part from each other.

568. The right crus is larger and longer than the left, and is always inſerted in the four upper vertebræ of the loins, and often in the fifth likewiſe, by the ſame number of digitations, which become more and more tendinous as they deſcend, and at length are expanded in form of an aponeuroſis. This crus lies more on the middle of the bodies of the vertebræ than on the right ſide.

569. The left crus is ſmaller and ſhorter, and lies more on the ſides of the vertebræ. It is fixed by digitations to the three upper vertebræ of the loins, ſeldom reaching lower. The lower part of it is expanded in the ſame manner as the other; and the two expanſions ſometimes meet together.

570. The oval opening of this inferior muſcle of the diaphragm, gives paſſage to the extremity of the œſophagus, and the aorta lies in the interſtice between the two crura. Immediately above the opening or hole, a thin faſciculus of fibres is ſent off to the ſtomach; and I have ſometimes obſerved a larger faſciculus at the lower extremity of the hole, ſent off chiefly from the right ala, and accompanied by ſome tendinous fibres from the left; which ſeemed to run to the meſentery.

571. In the middle aponeuroſis of the great muſcle, a little to the right of the anterior part of the ſlope, near the ſmall muſcle, is a round opening which tranſmits the trunk of the lower vena cava. The border or circumference of this opening

is very artfully formed by an oblique and ſucceſſive intertexture of tendinous fibres, almoſt like the edge of a wicker-baſket; and is conſequently incapable either of dilatation or contraction, by the action of the diaphragm.

572. We find therefore three conſiderable openings in the diaphragm; one round and tendinous for the paſſage of the vena cava; one oval and fleſhy for the extremity of the œſophagus; and one forked, partly fleſhy and partly tendinous, for the aorta. The round opening is to the right hand, cloſe to the upper part of the right ala of the ſmall muſcle; the oval opening is a little to the left, ſo that the right ala which is between theſe two holes, lies almoſt directly over-againſt the middle of the body of the eleventh vertebra of the back; the tendinous fork is under the oval opening, but a little more toward the middle.

573. This ſituation well conſidered, will ſerve to juſtify, in ſome meaſure, the deſcriptions and figures of the ancient anatomiſts, eſpecially ſince the right ala of the ſmall muſcle is larger than the left, and ſince it was an eaſy matter, in taking out the diaphragm, and ſpreading it on a board, to extend it too much toward both ſides.

§ 2. *Scaleni.*

Situation in general and diviſion.

574. Theſe are compound muſcles, irregularly triangular, and from this figure, the ancient Greeks gave them their name. They reckoned them to be only two in number, ſituated laterally on the vertebræ of the neck, all the way down to the firſt and ſecond true ribs. Afterwards they were divided into ſix, three lying on each ſide; but I have commonly found no more than two on each ſide, one lying upon the other; the firſt of which I name *ſcalenus primus* or *primæ coſtæ*, the other *ſcalænus ſecundus* or *ſecundæ coſtæ*.

575. The ſcalenus primus is fixed to the upper part of the outſide of the firſt rib, by two diſtinct portions, called commonly *branches*, one anterior, the other poſterior. The anterior branch is fixed to the middle portion of the rib, about an inch from the cartilage. From thence it runs obliquely upward, and is inſerted in the tranſverſe apophyſis of the ſixth, fifth, and ſometimes of the third vertebra of the neck.

576. The poſterior branch is fixed more backward in the firſt rib, an interſtice of about an inch being left between it and the other branch, through which the axillary artery and brachial nerves are tranſmitted. From thence it runs up obliquely behind the former, and is inſerted in all the tranſverſe apophyſes of the neck.

577. The ſcalenus ſecundus is fixed a little more backward in the external labium of the upper edge of the ſecond rib, ſometimes by two ſeparate portions, and ſometimes without any diviſion. The anterior portion is fixed immediately under the poſterior portion of the firſt ſcalenus, by a ſhort flat tendon, united a little with the firſt intercoſtal muſcle. From thence it runs up over the poſterior portion of the firſt ſcalenus, communicating likewiſe with that muſcle, and is fixed by inſertions, partly tendinous and partly fleſhy, in the tranſverſe apophyſes of the four firſt vertebræ of the neck.

578. The poſterior portion is fixed in the ſecond rib more backward than the other. From thence it runs up, being divided into two portions, whereof one is inſerted in the tranſverſe apophyſes of the three firſt vertebræ of the neck, behind the ſcalenus primus. The other portion runs up behind the former, and is inſerted in the tranſverſe apophyſes of the two firſt vertebræ.

579. The vertebral inſertions of both ſcaleni vary, they being ſometimes confounded with each other, and ſometimes with thoſe of the neighbouring muſcles. Behind the ſcalenus ſecundus, there is a ſmall fleſhy plane inſerted in the tranſverſe apophyſis of the laſt vertebra of the neck, and in the ſecond rib. This does not belong to the ſcaleni, but is the firſt of the muſculi ſupra-coſtales, or levatores coſtarum, as they are commonly called.

580. In diſſecting the anterior portion of the ſecond ſcalenus, I have obſerved a ſmall muſcle fixed to the extremity of the tranſverſe apophyſis of the laſt vertebra of the neck, which, having run down from thence to the inner and lower part of the firſt true rib, was ſlightly inſerted there, and ſeemed to continue its courſe to the convex ſide of the pleura. I have likewiſe ſeen all the ſcaleni inſerted in the firſt rib.

§ 3. *Serratus Poſticus Superior.*

Situation in general and inſertions.

581. This is a flat thin muſcle, ſituated on the upper part of the back. It is fixed on one ſide by a broad aponeuroſis, to the lower part of the poſterior cervical ligament, and to the ſpinal apophyſes of the two laſt vertebræ of the neck and two firſt of the back.

582. From thence it runs down a little obliquely forward and is inſerted, by broad fleſhy digitations, in the poſterior part of the ſecond, third, fourth, and ſometimes of the fifth true ribs, near their angles; but ſometimes it has no inſertion in the ſecond rib. It is covered by and cloſely united with the rhomboides.

§ 4. *Serratus Poſticus Inferior.*

Situation in general and inſertions.

583. This is a flat thin muſcle lying on the lower part of the back. It is fixed in the laſt ſpinal apophyſis of the back, and in the three firſt of the loins by a broad aponeuroſis. From thence it runs up a little obliquely, and is fixed by fleſhy broad digitations in the laſt four falſe ribs. Its inſertions in the loweſt rib is near the cartilage, and in the other three near their angles. It is covered by the latiſſimus dorſi, to which it adheres very cloſely, and it covers the ſacra-lumbaris and longiſſimus dorſi.

§ 5. *Intercoſtales.*

Situation in general and diviſion.

584. The intercoſtal muſcles are thin fleſhy planes, lying in the interſtices between the ribs, their fibres running obliquely from one rib to another. In each interſtice lie two planes, an external and an internal, cloſely joined together, nothing but a thin, fine, cellular, membranous web coming between them.

585. According to this natural diviſion, there muſt be forty-four intercoſtal muſcles, in the twenty-two interſtices left between the twenty-four ribs; and of theſe there are eleven external,

ternal, and eleven internal on each ſide. The fibres of the external intercoſtals run down from behind forward, and thoſe of the internal intercoſtals from before backward; ſo that the fibres of theſe two ſeries of muſcles croſs each other.

586. The external intercoſtals extend commonly from the vertebræ to the extremity of the upper labium of the bony portion of each rib, and go no further. The internal begin forward near the ſternum, and end backward at the angle of each rib.

587. Therefore, between theſe angles and the cartilages, theſe fleſhy planes are double, the fibres by their oppoſite directions repreſenting this kind of figure X. But from the vertebræ to the bony angles, and in the interſtices between the cartilaginous portions, the plane is ſingle, being that of the external muſcles, backward, and of the internal, forward.

588. The fibres of the external intercoſtals are very oblique near the vertebræ; but this obliquity decreaſes inſenſibly towards the anterior extremities of the ribs. Their inſertions begin at the ligaments by which the ribs are faſtened to the tranſverſe apophyſes. They are a little tendinous, and run a ſmall ſpace beyond the edge, on the outſide of each rib.

589. The fibres of the internal intercoſtals are in general ſhorter and leſs oblique than the former. They fill almoſt entirely the interſtices between the cartilaginous portions, and they are covered on the outſide by a ligamentary membrane, the fibres of which running in an oppoſite direction to thoſe of the muſcles, have been miſtaken for continuations of the external intercoſtals, over which this membrane is likewiſe ſpread, only a little diminiſhed in thickneſs.

590. Any portion of the breaſt of an animal may be boiled ſo much, as that the fleſh ſhall eaſily part from the bones, and the ribs may be drawn out, diſordering neither the muſcles nor membranes. But we are not from thence to conclude, that all the intercoſtals on one ſide of the thorax make but one muſcle, becauſe by the ſame way of reaſoning it might be proved, that all the muſcles which immediately ſurround the Os Femoris are but one, ſince, by a like experiment, they, together with the perioſteum, may be entirely ſeparated from the bone, without breaking their fibres.

§ 6. *Supra-coſtales.*

Situation in general.

591. Theſe muſcles are commonly called *levatores coſtarum*, which name was firſt given them by Steno, but he did not pretend to have diſcovered them. They are irregularly triangular, and ſituated on the back part of the ribs near the vertebræ.

Inſertions.

592. Each of theſe muſcles is fixed by one tendinous extremity in the tranſverſe apophyſis which lies above the articulation of each rib, and to the neighbouring ligament; the firſt being inſerted in the tranſverſe apophyſis of the laſt vertebra of the neck, and the laſt, in that of the eleventh vertebra of the back.

593. From thence the fleſhy fibres run down obliquely, increaſing in breadth as they deſcend, and are inſerted in the back part of the outſide of the following rib. Some of the fibres often paſs beyond that rib, and are fixed in one or more of the ribs below it by ſeveral digitations, which lie at a greater diſtance from the vertebræ in proportion as they run lower. In the inferior ribs theſe digitations are more conſiderable than in the ſuperior.

§ 7. *Sub-coſtales.*

Situation in general.

594. Theſe are fleſhy planes of different breadths and very thin, ſituated more or leſs obliquely on the inſides of the ribs near their bony angles, and running in the ſame direction with the external intercoſtals.

Inſertions.

595. They are fixed by both extremities in the ribs; the inferior extremity being always at a greater diſtance from the vertebræ than the ſuperior, and ſeveral ribs lying between the two inſertions.

596. Theſe muſcles are more ſenſible in the lower ribs than in the upper, and they adhere cloſely to the ribs that lie between their inſertions.

§ 8. *Sterno-coſtales vulgo Triangularis Sterni.*

Situation in general.

597. Theſe are five pairs of fleſhy planes diſpoſed more or leſs obliquely on each ſide of the ſternum,

num, on the inſide of the cartilages of the ſecond, third, fourth, fifth, and ſixth true ribs.

598. They are inſerted by one extremity in the edges of the inſide of all the lower half of the ſternum. From thence the firſt muſcle on each ſide runs up obliquely, and is fixed in the cartilage of the ſecond rib. The ſecond runs leſs obliquely to its inſertion in the cartilage of the third rib. The reſt are inſerted in the ſame manner in the cartilages of the following ribs; their obliquity decreaſing, and their length increaſing in proportion as they are ſituated lower down; ſo that the loweſt is almoſt tranſverſe. *Inſertions.*

599. This laſt muſcle which is fixed by one extremity in the cartilage of the ſixth true rib near the bone, and ſeems to paſs the appendix enſiformis, immediately above the inſertion of the diaphragm in that appendix, and to join the muſcle on the other ſide. The ſuperior portions of the tranſverſe muſcles of the abdomen, united with the loweſt ſterno-coſtales, have nearly the ſame appearance, ſo that theſe might be reckoned to belong to the tranſverſales, did not the inſertion of the diaphragm come between them.

ART. XIV.

The muſcles which move the head on the trunk.

600. THE head has proper motions diſtinct from thoſe of the neck, and others common to it with the neck. The muſcles which ſerve particularly for theſe motions are of two kinds, ſome of them being fixed by one extremity in the head, and the reſt having no inſertion in that part. Thoſe of the firſt kind are commonly twenty in number, to which four more are added, though they have no inſertion in the head. *Diviſion.*

601. Their number therefore amounts to twenty four, twelve lying on each ſide, viz. *Enumeration.*

1. *Sterno-Maſtoidæus ſive Maſtoides Anterior.*
2. *Splenius ſive Maſtoidæus Poſterior.*
3. *Complexus.*
4. *Complexus Minor ſive Maſtoidæus Lateralis.*
5. *Rectus Major.*
6. *Rectus Minor.*

7. *Obliquus Minor ſive Superior.*
8. *Obliquus Major ſive Inferior.*
9. *Rectus Anticus Longus.*
10. *Rectus Anticus Brevis.*
11. *Tranſverſalis Anticus Primus.*
12. *Tranſverſalis Anticus Secundus.*

Situation in general. 602. Of theſe twelve muſcles five are anterior, ſix poſterior, and one lateral.

603. The five anterior, are the ſterno maſtoidæus, rectus anticus longus, rectus anticus brevis, tranſverſalis anticus primus, tranſverſalis anticus ſecundus, which laſt is not inſerted in the head.

604. The ſix poſterior are the ſplenius, complexus major, rectus major, rectus minor, obliquus ſuperior, obliquus inferior, which laſt is not fixed in the head. The lateral muſcle is the complexus minor.

605. There are beſides theſe, ſometimes, ſmall ſupernumerary muſcles, which I ſhall mention after thoſe to which they belong; and I ſhall likewiſe give the reaſon why I retain the obliquus inferior, and tranſverſalis anticus ſecundus, though they belong more properly to the neck than to the head.

§ 1. *Sterno-Maſtoidæus ſive Maſtoidæus Anterior.*

Situation in general and diviſion. 606. This is a long, narrow, pretty thick, and moſtly fleſhy muſcle, ſituated obliquely between the back part of the ear, and lower part of the throat. It is in a manner compoſed of two muſcles united at the upper part through their whole breadth, and ſeparated at the lower.

Inſertions. 607. It has two inſertions below, both of them flat and a little tendinous. The firſt is in the upper edge of the ſternum near the articulation of the clavicula; the other in the clavicula at a ſmall diſtance from the ſternum. Theſe two portions run up obliquely, and unite together at about an inch above their lower inſertions, the triangular ſpace left between them being filled by a membrane.

608. The ſternal portion paſſes foremoſt and covers the clavicular, both forming one body or belly, which running in the ſame oblique direction to the apophyſis maſtoidæus, is inſerted in the upper and back part of that proceſs; over

which it likewiſe ſends off a very broad aponeuroſis, which covers the ſplenius, and is inſerted in the Os Occipitis.

609. The two anterior maſtoidæi repreſent a great Roman V, the angle being at the lower part of the throat, and the two crura running up behind the ears, as may be plainly ſeen without diſſection.

§ 2. *Splenius ſive Maſtoidæus Poſterior.*

610. This is a flat, broad, oblong muſcle, ſituated obliquely between the back part of the ear and the poſterior and lower part of the neck. It is partly made up of two portions, one ſuperior, the other inferior. Theſe two portions are cloſely united backward, making only one plane, but they are divided above.

Situation in general and diviſion.

611. The ſuperior portion is fixed to the extremities of the three or four loweſt ſpinal apophyſes of the neck, and of the firſt, or firſt and ſecond of the back. It is not fixed immediately to the apophyſes of the neck which are above the laſt, but only by the intervention of the poſterior cervical ligament.

612. It is likewiſe fixed to the edge of the inter ſpinal ligaments of the other vertebræ, and therefore its inſertions in the ſpinal apophyſes are not interrupted by the diſtances between theſe apophyſes, but form one thin continued plane a little tendinous.

613. From thence it runs up obliquely toward the maſtoide apophyſis, partly under the upper extremity of the ſterno-maſtoidæus, and is inſerted in the upper part of that proceſs, and along the neighbouring curve portion of the tranſverſe ridge of the Os Occipitis.

614. The inferior portion of the ſplenius is fixed to three or four ſpinal apophyſes of the back, beginning by the ſecond or third. From thence it runs up, being cloſely united to the other portion, till it reaches the ſuperior and lateral part of the neck, where it ſeparates from it, and is inſerted in the tranſverſe apophyſes of the three or four ſuperior vertebræ of the neck, by the ſame number of extremities a little tendinous, which however are ſometimes only two in number. This portion of the ſplenius belongs rather to the neck than to the head.

615. The two ſplenii repreſent a great Roman V; and the ſplenius and ſterno maſtoidæus of the ſame ſide, form a figure like a Roman A, or the legs of a pair of compaſſes, the points whereof are in an horizontal plane. Thus theſe four muſcles ſurrounding the neck, meet alternately at their upper and lower extremities.

§ 3. *Complexus.*

Situation in general.

616. This is a pretty long and broad muſcle lying on the poſterior lateral part of the neck, all the way to the occiput. It is complicated by reaſon of the decuſſations of its different portions, from which it has its name, but is commonly looked upon to be one muſcle.

Inſertions.

617. It is fixed below by ſmall ſhort tendons to the tranſverſe apophyſes of all the vertebræ of the neck except the firſt, to which it is fixed only near the root of its tranſverſe apophyſis. From thence it runs up obliquely backward, croſſing under the ſplenius, and often communicating with it by ſome faſciculi of fibres.

618. It is afterwards inſerted above by a broad fleſhy plane in the poſterior part of the ſuperior tranſverſe line of the Os Occipitis, near the criſta or ſpine of that bone. At its inſertion it joins by one edge the complexus of the other ſide, and by the other, the ſplenius which covers it a little.

619. Before we diſſect the ſplenii, we may ſee in the interſtice left between their ſuperior portions, the two complexi united together on the ſpine of the Os Occipitis.

§ 4. *Complexus Minor ſive Maſtoidæus Lateralis.*

Situation in general.

620. This is a long, ſlender, narrow, indented muſcle, lying along all the ſide of the neck up to the ear, where it increaſes a little in breadth. It is ſomething like the complexus major, and Veſalius took it to be a portion of that muſcle.

Inſertions.

621. It is fixed by one extremity in all the tranſverſe apophyſes of the neck, except the firſt, by the ſame number of digitations or branches moſtly fleſhy and diſpoſed obliquely.

622. From thence it aſcends, and having reached above the tranſverſe apophyſis of the firſt vertebra, it forms a ſmall broad plane, by which it is inſerted in the poſterior part of the apophyſis maſtoidæus. It is here covered by the ſplenius, and covers a little the obliquus ſuperior.

623. This muſcle is often miſtaken for a portion of the longiſſimus dorſi.

§ 5. *Rectus Major.*

Situation in general.

624. This is a ſmall, flat, ſhort muſcle, broad at the upper part and narrow at the lower; and though it is called *rectus*, it is ſituated obliquely between the occiput and ſecond vertebra of the neck.

Inſertions.

625. It is fixed below to one branch of the bifurcated ſpine of the ſecond vertebra of the neck, at a tuberoſity which is often found at the upper part of that branch. From thence it aſcends a little obliquely outward, and is inſerted in the poſterior part of the inferior tranſverſe line of the Os Occipitis, at a ſmall diſtance from the criſta, being a little covered by the obliquus ſuperior.

§ 6. *Rectus Minor.*

Situation and inſertions.

626. This muſcle is like the former, and it has alſo a ſmall inſertion below, in the poſterior eminence of the firſt vertebra. From thence it aſcends laterally, and is inſerted immediately under the poſterior part of the inferior tranſverſe line of the Os Occipitis, in a ſuperficial foſſula on one ſide of the criſta occipitalis.

§ 7. *Obliquus Superior ſive Minor.*

Situation and inſertions.

627. This muſcle is ſituated laterally between the occiput and firſt vertebra, being nearly of the ſame figure with the two recti. It is fixed to the end of the tranſverſe apophyſis of the firſt vertebra; from whence it runs upward and very obliquely backward, and is inſerted in the tranſverſe line of the Os Occipitis, almoſt at an equal diſtance from the criſta and maſtoide apophyſis,

phyſis, between the rectus major and complexus minor, which covers it a little.

§ 8. *Obliquus inferior ſive Major.*

Situation in general and inſertions.

628. It is ſituated in a contrary direction to the obliquus ſuperior, between the firſt and ſecond vertebra of the neck, reſembling that muſcle in every thing but the ſize. It is fixed below to one ramus of the bifurcated ſpinal apophyſis of the ſecond vertebra, near the inſertion of the rectus major, from whence it runs obliquely upward and outward, and is inſerted in the end of the tranſverſe apophyſis of the firſt vertebra under the lower inſertion of the obliquus ſuperior.

§ 9. *Rectus Anticus Longus.*

Situation in general.

629. This muſcle is in ſome meaſure of a pyramidal figure, lying along the anterior and lateral parts of the vertebræ of the neck, all the way up to the baſis cranii.

Inſertions.

630. It is fixed to the anterior parts of the tranſverſe apophyſis of the third, fourth, fifth, and ſixth vertebræ in a digitated manner. From thence it runs up obliquely inward towards the lateral parts of the bodies of the vertebræ, paſſes on the foreſide of the firſt and ſecond without being inſerted in them, and approaching gradually towards the ſame muſcle on the other ſide, it is inſerted near it, in the forepart of the lower ſide of the apophyſis baſilaris, or great apophyſis of the Os Occipitis.

§ 10. *Rectus Anticus Brevis.*

Situation and inſertions.

631. This is a ſmall flat muſcle, about the breadth of one finger, ſituated laterally on the anterior part of the body of the firſt vertebra. It is fixed below to the baſis or root of the tranſverſe apophyſis of that vertebra, near the anterior eminence.

632. From thence it runs obliquely upward and inward to a tranſverſe impreſſion in the lower ſide of the apophyſis ba-

ſilaris of the occipital bone, immediately before the condyle on the ſame ſide, being covered by the rectus anticus longus.

§ 11. *Tranſverſalis Anticus Primus.*

Situation and inſertions.

633. This is a ſmall, pretty thick, and wholly fleſhy muſcle, about the breadth of a finger, ſituated between the baſis of the Os Occipitis and the tranſverſe apophyſis of the firſt vertebra. It is fixed by one end in the anterior part of that apophyſis; and from thence running up a little obliquely, it is inſerted by the other end in a particular impreſſion between the condyle of the Os Occipitis and the maſtoide apophyſis of the ſame ſide, behind the apophyſis ſtyloides, and under the edge of the jugular foſſula.

§ 12. *Tranſverſalis Anticus Secundus.*

634. This is a ſmall muſcle ſituated between the tranſverſe apophyſes of the firſt two vertebræ of the neck. It is fixed by one extremity very near the middle of the ſecond apophyſis, and by the other near the root or baſis of the firſt; and therefore it is a muſcle of the neck rather than of the head.

§ 13. *Muſculi Acceſſorii.*

635. We ſometimes meet with a ſmall muſcle fixed by one end to the extremity of the firſt tranſverſe apophyſis of the neck near the inſertions of the two obliqui, from whence, running up obliquely, it is again inſerted behind the maſtoide apophyſis. This muſcle is commonly thought to be a third ſmall tranſverſalis on that ſide where it is found, but it ſeems rather to be an additional muſcle to the obliquus ſuperior. The recti and other obliqui are likewiſe ſometimes found double.

636. I call all theſe muſcles *acceſſorii* or *ſupernumerary*, becauſe they are ſometimes wanting, and becauſe when they are found, they vary both in number and ſituation.

ART. XV.

The vertebral muſcles in general.

637. THE muſcles which lie along the ſpine, the greateſt part whereof ſerve for the motions of the neck, back, and loins, have by the greateſt anatomiſts been thought very difficult to be well diſſected, and clearly deſcribed, eſpecially thoſe of the back. All theſe muſcles are very complex, interwoven with each other, and multiplied in various manners, ſo that it becomes neceſſary either to make their number much greater than that of the vertebræ, or to reduce them to a ſmall number of long muſcles interſected at different places.

638. STENO, in order to facilitate the knowledge, diſſection and deſcription of theſe muſcles, thought proper to rank them in the following manner. By vertebral muſcles he underſtands thoſe which are fixed in the vertebræ alone; and he diſtinguiſhes them all into *recti* and *obliqui*. The recti are thoſe which run parallel to the medulla ſpinalis, or whoſe direction is longitudinal. The obliqui are thoſe which run obliquely between the ſpinal and tranſverſe apophyſes.

639. He divides the recti into middle and lateral. The middle recti are thoſe which are fixed to the ſpinal apophyſes; the lateral thoſe fixed to the tranſverſe apophyſes. He moreover divides all theſe muſcles into ſimple and compound; the ſimple being thoſe which are fixed in two vertebræ only; the compound, thoſe fixed in more than two.

640. The obliqui, according to him, are of two kinds. Some run up from the tranſverſe to the ſpinal apophyſes, approaching each other; and ſome run up from the ſpinal to the tranſverſe apophyſes, diverging from each other. The firſt ſort he terms *ad medium vergentes*; the ſecond *a medio recedentes*. Theſe terms are borrowed from optics, and accordingly theſe two kinds of muſcles might be named *converging* and *diverging muſcles*. Laſtly, he adds, that ſeveral muſcles of the firſt kind go from one tranſverſe to ſeveral ſpinal apophyſes; and from ſeveral tranſverſe to one ſpinal apophyſis.

641. According to this account of the vertebral muſcles, the ancient terms *ſpinales*, *tranſverſales*, and *ſemi-ſpinales*, may

ſtill be applied to them; underſtanding by ſpinales thoſe muſcles which are wholly fixed in the ſpinal apophyſes; by tranſverſales, thoſe which are wholly fixed in the tranſverſe apophyſes; and by ſemi-ſpinales, thoſe which are fixed in the ſpinal apophyſes by one extremity only. At preſent the two kinds of oblique vertebral muſcles are better expreſſed by the two compound terms, *tranſverſo-ſpinales* and *ſpino-tranſverſales*.

642. It is however neceſſary ſtill to retain the general names of *vertebrales recti*, *vertebrales obliqui*, &c. becauſe though the terms already mentioned agree very well to the poſterior obliqui, they cannot be applied to the anterior obliqui, one end of which is fixed not in the ſpinal apophyſes, but in the bodies of the vertebræ.

643. The ſmall ſimple muſcles that go only between two vertebræ, may be termed *vertebrales minores*; and the large compound muſcles that reach ſeveral vertebræ, *vertebrales majores*, both ſorts being afterwards divided into ſpinales and tranſverſales majores and minores. The ſmall muſcles are likewiſe called *inter-ſpinales* and *inter-tranſverſales*; and as there are ſome ſmall oblique muſcles which cannot be ſaid to reach either the tranſverſe or ſpinal apophyſes, theſe may be termed ſimply *inter-vertebrales*.

644. The tranſverſo-ſpinales that go from ſeveral tranſverſe to one ſpinal apophyſis are diſpoſed in this manner. The portion that comes from the moſt tranſverſe apophyſis is inſerted in the extremity of the ſpinal apophyſis, the portion from the next tranſverſe apophyſis is inſerted more laterally, and the ſame rule holds in all the other portions, except in that which comes from the tranſverſe apophyſis which is neareſt the ſpinal apophyſis.

645. This laſt portion is not fixed in the ſpinal apophyſis, but rather in its root or baſis, and likewiſe very near the baſis of the tranſverſe apophyſis, ſo that it is more properly inter-vertebralis than tranſverſo-ſpinalis. Thus in the tranſverſo-ſpinales that go from the ninth, eighth, ſeventh, and ſixth tranſverſe apophyſes of the back to the fifth ſpinal apophyſis of the ſame claſs, we find that the laſt and ſmalleſt is fixed in the baſis of the ſixth tranſverſe and of the fifth ſpinal apophyſis.

646. The tranſverſo-ſpinales which go from one traſverſe to ſeveral ſpinal apophyſes, are diſpoſed in this manner. The

portion that goes from the baſis, or near the baſis of the tranſverſe apophyſis, is fixed either in or near the baſis of the ſpinal apophyſis immediately above it. The next portion, which is more diſtant from the baſis of the tranſverſe apophyſis, runs up beyond the next ſpinal apophyſis, and is inſerted in that above it, a little further from the baſis.

647. The other portions obſerve the ſame order, that which comes from the apex of the tranſverſe apophyſis being inſerted in the apex of the moſt diſtant ſpinal apophyſis. From this diſpoſition we ſee that the moſt ſuperior vertebral muſcles which go from one tranſverſe to ſeveral ſpinal apophyſes, are the moſt inferior of thoſe which go from ſeveral tranſverſe to one ſpinal apophyſis.

648. It muſt be obſerved, that in ſpeaking of the oblique vertebral muſcles, I conſider their direction from below upward, and not from above downward, becauſe the inferior vertebræ commonly ſupport thoſe above them, except when a perſon ſtands upon his head, with his feet erect, in which caſe the ſuperior vertebræ ſuſtain the inferior.

649. We ought likewiſe to remark, that in ſpeaking of theſe muſcles the term *tranſverſalis* is more proper than *tranſverſus*, which laſt points out a certain direction very different from that which theſe muſcles have; whereas the other marks the relation which they have to the tranſverſe apophyſes.

650. Beſides the *vertebral muſcles* properly ſo called, ſeveral other muſcles not inſerted wholly in the vertebræ, ſerve to move them. Some of the ancients called theſe *ſemi-ſpinales*, to diſtinguiſh them from thoſe they termed *ſpinales*, which included all the vertebral muſcles; and therefore as we have termed theſe *vertebrales*, the others may be named *ſemi-vertebrales*.

651. Among the *vertebrales* properly ſo called, ſome, from their inſertions, ſeem to be common to the neck and the back, ſome to the back and loins; but, for diſtinction's ſake, I reckon among thoſe of the neck, not only the muſcles entirely fixed in the vertebræ thereof, but alſo thoſe whoſe ſuperior inſertion is in the ſeventh vertebræ of the neck, though all their other inſertions be in thoſe of the back; and I obſerve the ſame method with reſpect to the loins.

652. All theſe muſcles vary very much in their inſertions and reciprocal communications; by which laſt they are often ſo

much confounded together, that it is a very difficult matter to diſtinguiſh them, for thoſe who are not previouſly acquainted with them. In general, they are more eaſily diſtinguiſhed in children than in adults, and in adults than in very aged perſons.

653. In deſcribing theſe muſcles I confine myſelf chiefly to what I have moſt commonly obſerved myſelf; without pretending to contract or diſcredit what other very great anatomiſts have publiſhed about them.

ART. XVI.

The vertebral muſcles in particular.

654. THE muſcles that move the neck in particular, are very many in number, as has been already obſerved in ſpeaking of the vertebral muſcles in general; but in order to ſhun all confuſion, and eaſily to form an idea of them, they may be taken collectively, and thereby be reduced to twelve, ſix on each ſide, of which one is ſituated on the foreſide of the neck, the reſt on the backſide.

Muſcles of the neck.

655. The muſcle, which with its fellow lies on the foreſide of the neck, is named,

1. *Longus Colli.*

656. Thoſe on the backſide are,

2. *Tranſverſalis Colli Major.*
3. *Tranſverſalis Gracilis ſive Collateralis Colli.*
4. *Semi-ſpinalis ſive Tranſverſo ſpinalis Colli.*
5. *Spinales Colli parvi ſive Inter-ſpinales.*
6. *Tranſverſales Colli Minores ſive Inter-tranſverſales.*

657. The ſpinales minores and tranſverſales minores are here reckoned collectively; for if we take them ſeparately, there are ſix or ſeven of each ſort on each ſide of the neck; neither is the number of them always the ſame. The tranſverſalis gracilis has often been looked upon as a portion of that long muſcular maſs termed *longiſſimus dorſi.* It has likewiſe been taken by ſome for the cervicales deſcendens of

Diemerbroek, and by others it has been called *Acceſſorius Stenonis.*

658. We ought likewiſe to reckon among the muſcles of the neck, two of which have been deſcribed among thoſe of the head, *viz.*

7. *Obliquus Major.* 8. *Rectus Minor.*

659. I do not ſpeak here of other muſcles which aſſiſt in moving the neck, that is, all thoſe that move the head, except the ſmall ones inſerted in the cranium, and in the firſt vertebra of the neck.

§ 1. *Longus Colli.*

Situation in general and inſertions. 660. This vertebral muſcle is made up of ſeveral others, ſituated laterally along the foreſide of all the vertebræ of the neck, and ſome of the upper vertebræ of the back.

Diviſion. 661. It may be divided into two portions, one ſuperior, conſiſting of oblique converging muſcles, and one inferior, compoſed of oblique diverging muſcles.

662. The ſuperior portion is covered by the rectus anticus longus of the head. The muſcles, of which it conſiſts, are fixed below to all the tranſverſe apophyſes that lie between the firſt vertebra and the laſt. From thence they run up obliquely, and are inſerted in the anterior eminence of the firſt vertebra, and in the bodies of the three following. The inſertion in the eminence is ſo cloſely united to the ligament which goes to the Os Occipitis, that it can hardly be diſtinguiſhed from it.

663. The inferior portion appears almoſt ſtraight, and yet all the muſcles that compoſe it are diverging, or directed obliquely outward. They are fixed below, to the anterior lateral part of the body of the laſt vertebra of the neck, and of the firſt three of the back, and ſometimes of more. From thence they run upward and a little obliquely outward and are inſerted near the tranſverſe apophyſes of all the vertebræ of the neck, except the firſt and laſt.

664. Though theſe two portions ſeem to be confounded with each other, they may nevertheleſs be eaſily diſtinguiſhed by an oblique line that runs between them from the tranſverſe apophyſis of the ſecond vertebra to the body of the ſixth.

665. The

665. All the inſertions of this muſcle are more or leſs tendinous.

§ 2. *Tranſverſalis Colli Major.*

666. This is a long thin muſcle, placed along all the tranſverſe apophyſes of the neck, and the four, five, or ſix upper apophyſes of the back, between the complexus major and minor, lying, as it were, on the inſertions of the firſt of theſe muſcles. *Situation in general.*

667. It is compoſed of ſmall muſcular faſciculi, which run directly from one or more tranſverſe apophyſes, and are inſerted ſometimes in the apophyſis neareſt to theſe, ſometimes in others more remote, the ſeveral faſciculi croſſing each other between the inſertions of the two complexi, which are likewiſe croſſed by them. They have ſometimes a communication with the longiſſimus dorſi, but this is not uniform. *Inſertions.*

§ 3. *Tranſverſalis Gracilis ſive Collateralis Colli.*

668. This is a long thin muſcle, reſembling the tranſverſalis major in every thing but ſize, and ſituated on the ſide of that muſcle. It is commonly taken for a portion or continuation of the ſacro-lumbaris. Diemerbroek diſtinguiſhed it by the name of *cervicalis deſcendens*; and Steno, and others after him, have called it *acceſſorius muſculi ſacro-lumbaris*, in ſpeaking of which muſcle I ſhall have occaſion to mention it again.

§ 4. *Semi-Spinalis ſive Tranſverſo-Spinalis Colli.*

669. This name is given to all that fleſhy maſs which lies between the tranſverſe and ſpinal apophyſes from the ſecond vertebra of the neck to the middle of the back; the ſplenius and complexus major which cover it, having been raiſed. *Situation.*

670. It is compoſed of ſeveral oblique converging muſcles, which may be divided into external and internal, and of theſe the external are the longeſt. *Diviſion.*

671. The external are fixed below, to the tranſverſe apophyſes of the ſix, ſeven, eight, or nine upper vertebræ of

the back, by tendinous extremities, which, as they aſcend, become fleſhy, and mix with each other. Their ſuperior inſertions in the neck, are ſix in number, whereof the firſt, which is tendinous, is in the ſeventh ſpinal apophyſis; the reſt, which are fleſhy, are in the five next ſpinal apophyſes.

672. The loweſt of theſe external muſcles mix more or leſs by ſome communicating fleſhy fibres, with the ſpinalis, longiſſimus, and ſemi-ſpinalis dorſi.

973. The internal are ſhorter and more oblique than the external, and partly covered by them. They are fixed by their lower extremities to the tranſverſe apophyſes of the three or four upper vertebræ of the back and to the oblique apophyſes of the four or five lower vertebræ of the neck; and by their other extremities they are inſerted in the ſix ſpinal apophyſes of the neck.

674. Some of theſe internal muſcles are very ſhort, lying wholly between the ſpinal apophyſes and the oblique or tranſverſe apophyſes next them.

§ 5. *Spinales Colli Minores.*

Situation and inſertions.

675. Theſe muſcles lie between the ſix ſpinal apophyſes of the neck, and between the laſt of the neck and firſt of the back, being inſerted in theſe apophyſes by both extremities on one ſide of the poſterior cervical ligament, which parts them from thoſe on the other ſide. They are likewiſe termed *inter-ſpinales*.

§ 6. *Tranſverſales Colli Minores.*

676. Theſe are very ſmall ſhort muſcles, found in the interſtices of ſeveral tranſverſe apophyſes in which they are inſerted. They are likewiſe termed *inter-tranſverſales*.

Muſcles of the back, loins, and Os Coccygis.

677. The muſcles which move the vertebræ of the back and loins would amount to a much greater number, and be much more difficult to conceive than thoſe of the neck, were they to be reckoned ſeparately as vertebral or ſemi-vertebral muſcles. It is therefore proper to reduce them to a collective number, which may conveniently enough be fixed to twenty-four, twelve on each ſide, *viz.*

1. *Sacro-Lumbaris.*
2. *Longiſſimus Dorſi.*
3. *Spinalis Dorſi Major.*
4. *Spinales Dorſi Minores.*
5. *Tranſverſalis Dorſi Major.*
6. *Tranſverſales Dorſi Minores.*
7. *Semi Spinalis ſive Tranſverſo-Spinalis Dorſi.*
8. *Semi-Spinalis ſive Tranſverſo Spinalis Lumborum, Sacer Veterum.*
9. 10. *Spinales & Tranſverſales Lumborum.*
11. *Quadratus Lumborum ſive Lumbaris Externus.*
12. *Coccygæi.*

678. The vertebræ of the back, and eſpecially thoſe of the loins, may likewiſe be moved by the muſcles of the abdomen, as has been already obſerved. The inferior portion of the longus colli may contribute ſomething to the motion of the upper vertebræ of the back; the pſoas to that of the vertebræ of the loins, and the glutæus maximus to that of the Os Coccygis.

§ 7. *Sacro-lumbaris.*

Situation and name.

679. This is a long complex muſcle, narrow, and thin at the upper part, broad and thick at the lower, repreſenting a kind of flat pyramid. It lies between the ſpine and poſterior part of all the ribs, and along the back-part of the regio lumbaris, all the way to the Os Sacrum.

680. Through all this ſpace it is cloſely accompanied by the longiſſimus dorſi, which lies between it and the ſpinal apophyſes of the vertebræ, a narrow, fatty, or cellular line running between them. The name of *lumbo-coſtalis* would better expreſs the ſituation of this muſcle than that of the ſacro-lumbaris. It might be termed *medius dorſi,* to diſtinguiſh it from the latiſſimus and longiſſimus dorſi, between which it is placed.

Inſertions.

681. It is fixed below by a broad thin tendinous aponeuroſis to the ſuperior ſpines of the Os Sacrum, and to the neighbouring lateral parts of that bone; and laſtly, to the external labium of the poſterior part of the criſta Oſſis Ilium, all the way to the great tuberoſity. The aponeuroſis covers and adheres very cloſely to the lower part of the longiſſimus dorſi; and where it is fixed to the Os Sacrum, it is a little covered by ſome inſertions of the glutæus maximus.

682. From thence this muſcle runs upward and a little

laterally, over all the regio lambaris, the aponeuroſis ſending off from its inſide a maſs of fleſhy fibres, which are divided from below upwards, into ſeveral large faſciculi inſerted in all the tranſverſe apophyſes of the loins.

683. Afterwards it runs up obliquely over all the ribs, ſometimes as high as the two or three loweſt vertebræ of the neck, ſometimes higher, and ſometimes it ends at the firſt vertebra of the back.

684. Through all this extent the ſide of the muſcle next the longiſſimus dorſi or vertebræ, is very even; but that next the ribs is divided into ſeveral portions in an oblique diſpoſition from below upwards, reſembling in ſome meaſure the branch of a palm-tree. Theſe portions or digitations, are fixed in the tranſverſe apophyſes of the neck, in the tuberoſity of the firſt rib, in the lower part of the angular impreſſions of the ten following ribs, and near the extremity of the laſt rib.

685. This digitation belonging to the laſt rib is broad and more fleſhy than tendinous. Thoſe of the other ribs are tendinous, flat, and narrow, and thoſe of the neck are ſomething fleſhy, but very ſlender. The moſt ſuperior portions are longer and narrower than thoſe below them, they growing gradually ſhorter and broader as they deſcend.

686. In diſſecting this muſcle with care, between theſe portions and the ribs, we meet with ſeveral long thin muſcular faſciculi, which croſſing the portions and adhering to them, are afterwards fixed in the ribs above and behind the inſertions of the ſeveral portions.

687. Theſe muſcular faſciculi begin at the tranſverſe apophyſes of the ſame vertebræ of the neck, from whence they run down, and are fixed in the eight or nine following ribs. Sometimes they paſs over ſeveral ribs without being inſerted in them; but this varies in different ſubjects, and ſometimes in the two ſides of the ſame ſubject.

688. In this manner theſe faſciculi form a particular plane, which ſome take for the internal portion of the ſacro-lumbaris; others, after Steno, call it *muſculus acceſſorius ſacro-lumbaris*. Some take it for a diſtinct muſcle, calling it the *cervicalis deſcendens of Diemerbroek*. I have already mentioned it among the muſcles which move the vertebræ of the neck, by the name of *tranſverſalis gracilis colli*.

§ 8. *Lon-*

§ 8. *Longiſſimus Dorſi.*

689. This is a very complex, long, and narrow muſcle, ſomething like the ſacro-lumbaris, but more fleſhy and thicker, ſituated between the ſpinal apophyſes and the muſcle juſt mentioned, from which it is divided by a ſmall, fatty, or cellular line, but at the lower part they are confounded together. It covers the ſemi-ſpinalis or tranſverſo-ſpinalis dorſi and the ſemi-ſpinalis lumborum. Its upper part lies between the ſacro-lumbaris and tranſverſalis colli. *Situation in general.*

690. Its inferior inſertions are partly by diſtinct tendinous portions, and by a broad aponeuroſis common to it with the ſacro-lumbaris, and partly by large faſciculi of fleſhy fibres, which at firſt ſight ſeem to compoſe one uniform maſs. It is fixed by the long, flat, tendinous portions, of different breadths, to the laſt ſpinal apophyſis of the back, to all thoſe of the loins, and to one or two of the ſuperior ſpines of the Os Sacrum. Theſe portions lie at different diſtances from each other, but are all connected by a thin aponeuroſis fixed to their edges. *Inſertions.*

691. From thence they run up obliquely, diverging from the apophyſes, and beginning to be fleſhy at their inner or anterior ſides, they terminate above in ſmall roundiſh tendons, inſerted in the extremities of the ſeven upper tranſverſe apophyſes of the back, and in the neighbouring ligaments of all the true ribs. Sometimes one inſertion in the vertebræ of the back is wanting, and ſometimes there is one in the tranſverſe apophyſis of the laſt vertebra of the neck.

692. The other inferior inſertion wholly fleſhy, is partly in the inner or foreſide of the aponeuroſis of the ſacro-lumbaris, and partly in the upper portion of the Os Sacrum, being from thence continued to the great tuberoſity of the Os Ilium, ſo that the aponeuroſis of the ſacro-lumbaris ſeems to afford a third inſertion to the longiſſimus dorſi.

693. From thence this uniform maſs of fleſhy fibres runs up in a courſe almoſt direct, croſſing the tendinous portions which are more oblique; and join the inferior fibres of the ſacro-lumbaris by large faſciculi inſerted in the tranſverſe and oblique apophyſes of the vertebræ of the loins. The fibres

of this portion go afterwards to the ribs, being inſerted by planes more or leſs fleſhy, in the lower convex edge of all the falſe ribs, between the condyles or tuberoſities and the angles.

694. At the ſixth or ſeventh vertebra of the back, one or more of the tendinous portions often communicate with ſome faſciculi of the ſemi-ſpinalis or tranſverſo ſpinalis dorſi.

695. By this deſcription we ſee that the longiſſimus dorſi is in part a great ſemi-ſpinalis divergens or ſpino-tranſverſalis, much in the ſame manner as the inferior portion of the ſplenius.

696. In examining the dorſal inſertions of this muſcle, we meet with ſeveral muſcular faſciculi which croſs the tendinous portions near the ſpine, but without adhering ſo ſtrongly to them as thoſe already mentioned do to the ſacro-lumbaris, which they reſemble in every other circumſtance. Theſe faſciculi are fixed above, to the tranſverſe apophyſes of the three or four firſt vertebræ of the back, and below to thoſe of the ſixth and ſeventh.

697. I have obſerved other ſuch faſciculi fixed in the tranſverſe apophyſes of the back from the firſt to the ninth incluſively, and ſituated between the extremities of the tranſverſalis major colli, and of the longiſſimus dorſi with which they communicate at the third vertebra or thereabouts.

698. Theſe faſciculi might be reckoned a muſculus acceſſorius longiſſimi dorſi, or a tranſverſalis dorſi, in the ſame manner as that of the ſacro-lumbaris already mentioned.

699. Some anatomiſts imagine that the longiſſimus dorſi is continued all the way to the apophyſis maſtoidæa of the cranium, taking the complexus minor or maſtoidæus lateralis to be a portion of this muſcle.

700. This muſcle and the ſacro-lumbaris are common to the back and loins.

§ 6. *Spinalis Dorſi Major.*

Situation in general. 701. This is a pretty long and ſlender muſcle, lying upon the lateral part of the extremities of the ſpinal apophyſes of the back.

702. It is compoſed of ſeveral muſcular faſciculi of diffe-

rent lengths, which croſſing each other, are inſerted laterally by ſmall tendons in the ſpinal apophyſes from the ſecond, third, or fourth vertebra of the back, and ſometimes, though ſeldom, from the laſt of the neck or firſt of the back; all the way to the firſt or ſecond vertebra of the loins, with ſeveral irregular decuſſations which vary in different ſubjects. *Inſertions.*

703. The longeſt faſciculi are a little incurvated, becauſe they incloſe the reſt, which are gradually diſpoſed between the long ones and the ſpinal apophyſes; ſo that this muſcle which terminates by both extremities in points, is of ſome conſiderable breadth in the middle.

704. It communicates by ſome fibres with the longiſſimus dorſi and ſemi-ſpinalis or tranſverſo ſpinalis; and it ſends off faſciculi to ſeveral tranſverſe apophyſes of the back from the fourth to the eleventh.

705. It is commonly named *ſemi-ſpinalis*, but very improperly, as appears from what has been ſaid about the vertebral muſcles in general.

§ 10. *Spinales Dorſi Minores.*

706. Theſe muſcles are of two kinds. Some go laterally from the extremity of one ſpinal apophyſis to another; being often mixed with the ſhort faſciculi of the ſpinalis major. The reſt lie directly between the extremities of two neighbouring ſpinal apophyſes, being ſeparated from their fellows on the other ſide, by the ſpinal ligament. They are ſmaller and thinner than thoſe of the neck, and are properly enough termed *inter-ſpinales*. *Diviſion and inſertions.*

§ 11. *Tranſverſalis Dorſi Major.*

707. This muſcle was deſcribed together with the longiſſimus dorſi.

§ 12. *Tranſverſales Dorſi Minores.*

708. I have found ſome particular muſcles of this kind fixed to the extremities of the three loweſt tranſverſe apophyſes of the back. The reſt are all in ſome meaſure continuations of the tranſverſalis major; but theſe few which are diſ-

tinct, and which lie in the interſtice between two apophyſes, may juſtly enough be termed *inter-tranſverſales.*

§ 13. *Semi-ſpinalis ſive Tranſverſo-ſpinalis Dorſi.*

Situation in general. 709. This is a fleſhy maſs, which, from all the ſpinal and tranſverſe apophyſes of the back and loins, is extended in diſtinct faſciculi over the vertebræ themſelves.

Inſertions. 719. It is made up like that of the neck, of ſeveral oblique converging vertebral muſcles, the uppermoſt of which is fixed below, to the third tranſverſe apophyſis of the back, and above to the firſt ſpinal apophyſis. The loweſt is fixed below, to the third tranſverſe apophyſis of the loins, and above to the laſt ſpinal apophyſis of the back.

Diviſion. 711. They may be divided into external, which are firſt diſcovered, and internal, which lie immediately on the vertebræ. The external from the firſt vertebra to the ſeventh, incluſively, appear to be longer than the internal, which are covered by them. They may likewiſe be diſtinguiſhed into thoſe which go from one tranſverſe to ſeveral ſpinal apophyſes, and thoſe which go from ſeveral tranſverſe to one ſpinal apophyſis.

§ 14. *Tranſverſo-ſpinalis Lumborum, Sacer Veteribus.*

Situation in general. 712. This muſcle is compoſed of ſeveral oblique converging or tranſverſo-ſpinal muſcles in the ſame manner as in the back and neck; and it lies between the ſpinal and oblique apophyſes of the loins, reaching to the Os Sacrum.

713. The loweſt of theſe muſcles are fixed to the ſuperior lateral parts of the Os Sacrum, to the ligamentum ſacro-iliacum, and to the poſterior ſuperior ſpine of the Os Ilium. The reſt are fixed to the three loweſt tranſverſe apophyſes, and to the four loweſt oblique apophyſes of the loins, and to their lateral tuberoſities. From thence they run up to all the ſpinal apophyſes of theſe vertebræ, the external, or thoſe that appear firſt, being longer than the internal, which lie immediately on the vertebræ, eſpecially toward the lower part.

§ 15. *Spinales & Tranſverſales Lumborum*

714. There are ſome faſciculi which run up from the ſuperior falſe ſpines of the Os Sacrum, to the lower ſpinal apophyſes of the loins, which may be looked upon as ſo many ſpinales lumborum majores. There are likewiſe ſome ſpinales minores between the ſpinal apophyſes of the loins, and tranſverſales minores between the tranſverſe apophyſes, which are ſometimes of a conſiderable breadth.

§ 16. *Quadratus Lumborum ſive Lumbaris Externus.*

715. This is a ſmall, oblong, flat muſcle, irregularly ſquare, narrower at its upper than at its lower part, lying along the ſides of the vertebræ lumborum between the laſt falſe rib and the Os Ilium. *Situation in general.*

716. It is fixed below to the external labium of almoſt all the poſterior half of the criſta Oſſis Ilium, to the ligamentum ſacro-iliacum, and a little to the Os Sacrum, by a fleſhy plane, the fibres whereof run obliquely backward. *Inſertions.*

717. From thence it runs up between the ſacro-lumbaris and pſoas, by both which it is partly hid, and is inſerted in the extremities of all the tranſverſe apophyſes of the loins by oblique tendinous digitations. It is likewiſe fixed by a broad inſertion in the twelfth rib, on the inſide of the ligament that lies between it and the longiſſimus dorſi, by which that rib is connected to the firſt vertebra of the loins.

718. I have obſerved likewiſe a ſmall lumbaris externus adhering very cloſely to the backſide of the quadratus, and fixed by tendinous digitations to the extremities of the ſecond, third, and fourth tranſverſe apophyſes of the loins. From thence its fleſhy fibres run up obliquely over the quadratus, and then mix with it at its inſertion in the laſt falſe rib.

§ 17. *Muſculi Oſſis Coccygis.*

719. Theſe are ſmall, thin, radiated muſcles lying on the

inner or concave ſide of the Os Sacrum, and neighbouring parts of the pelvis. They are four in number, two on each ſide, whereof one is placed more forward, the other more backward; for which reaſon the firſt may be termed *coccygæus anterior ſive iſchio-coccygæus*; the other *coccygæus poſterior ſive ſacro-coccygæus*.

720. The coccygæus anterior is fixed by a broad inſertion in the anterior portion of the ſmall tranſverſe ligament at the upper part of the foramen ovale of the Os Innominatum, which, as was obſerved in the deſcription of the freſh bones, is no more than a particular fold of the great tranſverſe ligament of the pelvis. From thence it runs between this great ligament and the muſculus obturator internus, with which it is often confounded by anatomiſts, and contracting in breadth, it is inſerted in the lower part of the Os Coccygis.

721. The coccygæus poſterior, or ſacro-coccygæus, is fixed to the inner or concave edge of the two firſt vertebræ of the Os Sacrum, to the inner and lower edge of the ligamentum ſacro-ſciaticum, and to the ſpine of the Os Iſchium. From thence contracting in breadth, it is inſerted in the inſide of the Os Coccygis above the former muſcle.

§ 18. *Pſoas Parvus.*

Situation.

722. This is a long ſlender muſcle lying upon the pſoas major. It is ſometimes wanting; and Riolan, who met with it often in men, takes notice of his having found it once in a woman, as a thing very extraordinary. As for my own part, I found it ſeveral times in women before I ever met with it in men, and I ſtill continue to obſerve it moſt frequently in that ſex.

723. It is fixed above by a ſhort tendon, ſometimes to the laſt tranſverſe apophyſis of the back, or higher; ſometimes to the firſt of the loins, and ſometimes to both. From thence it runs down wholly fleſhy, and more or leſs complex, on the great pſoas in a direction a little oblique.

724. Having reached the middle of the regio-lumbaris or thereabouts, it forms a ſlender flat tendon, which gradually increaſing in breadth, like a thin aponeuroſis, runs over the pſoas major and iliacus internus at their union, and from thence down to the ſymphyſis of the Os Pubis and Os Ilium,

and is inſerted chiefly in the criſta of the Os Pubis above the inſertion of the pectineus, ſometimes ſending an aponeurotic lamina further down.

725. Beſides this pſoas parvus, there is another ſtill ſmaller, between it and the vertebræ, inſerted much in the ſame manner. This muſcle I diſcovered in the year 1713.

ART. XVII.

The muſcles which move the lower jaw.

726. THeſe muſcles are ten in number, five on each ſide, *viz.*

1. *Maſſeter.*
2. *Temporalis,*
3. *Pterygoidæus Major ſive Internus.*
4. *Pterygoidæus Minor ſive Externus.*
5. *Digaſtricus.*

727. To theſe ſome add the two muſculi cutanei; but very improperly, for a reaſon which ſhall be given in another place.

§ 1. *Maſſeter.*

728. This is a very thick fleſhy muſcle, ſituated at the back part of the cheek. It ſeems to be made up of three portions, like a triceps, *viz.* one large and external portion, one middle, and one ſmall and internal. *Situation.*

729. The external portion is fixed by one tendinous extremity to all the inferior edge of the Os Malæ. and a little to the neighbouring parts of the Os Maxillare and apophyſis zygomatica of the Os Temporum. From thence it runs down obliquely backward, being wholly fleſhy, and is inſerted by the other extremity in the rough impreſſion on the outſide of the angle of the lower jaw.

730. The middle portion is fixed by one end to the lower edge of the whole apophyſis zygomatica of the Os Temporum, and a very little to that of the Os Malæ. From thence it runs down a little obliquely forward in an oppoſite direction to the firſt portion, under which it croſſes; and is inſerted by its other extremity in the middle of the inſide of the ramus

of the lower jaw, near the inſertion of the external portion with which it mixes.

731. The third portion which is leaſt and moſt internal, is fixed by one extremity to the inner labium of the lower edge, and alſo to the inſide of almoſt all the zygomatic arch; and by the other, to the root or baſis of the coronide apophyſis, where it mixes wholly fleſhy with the inſertion of the middle portion. This third portion, by its nearneſs of ſituation, ſeems ſometimes to be an appendix of the temporal muſcle.

§ 2. *Temporalis.*

732. This is a broad flat muſcle, reſembling the quadrant of a circle in figure. It occupies all the ſemi-circular or ſemi-oval plane of the lateral region of the cranium, the temporal foſſa, and part of the zygomatic foſſa. From this ſituation it has its name, and likewiſe that of crotaphites, which is ſometimes given to it.

Situation in general.

733. To conceive juſtly the inſertions of this muſcle, it muſt be obſerved, that through all the circumference of the ſemi-circular plane already mentioned, the pericranium is divided into two laminæ. The internal lamina ſometimes taken for a particular perioſteum, covers immediately all the bony parts of this region. The external lamina ſeparated from the other, is ſpread out like an aponeurotic or ligamentary tent, by means of its adheſions to the external angular apophyſis of the Os Frontis, to the poſterior edge of the ſuperior apophyſis of the Os Malæ, and to the upper edge of all the zygomatic arch, all the way to the root of the maſtoide apophyſis.

Inſertions.

734. This muſcle is compoſed of two planes of fleſhy fibres, fixed to the two ſides of a tendinous plane nearly of the ſame breadth with them, it being ſpread quite through the muſcle like a concealed middle tendon; as may be plainly ſeen by dividing the muſcle all the way to the bone, according to the direction of its fibres. The body of the muſcle thus formed is incloſed between the two aponeurotic or ligamentary laminæ in the following manner.

Diviſion.

735. The internal fleſhy plane is fixed by a broad radiated inſertion, to all the ſemicircular plane of the cranium, by the intervention of the internal lamina of the perioſteum.

736. Thus it is fixed to the lateral external part of the Os Frontis, and to its external angular apophyſis, to the lower part of the Os Parietale, to the ſquammous portion of the Os Temporis, to the great ala or temporal apophyſis of the ſphenoidal bone, by which the temporal foſſa is formed; and a little to the backſide of the internal orbitary apophyſis of the Os Malæ which forms part of the zygomatic foſſa.

737. Through all this ſpace the fleſhy fibres contract gradually, by means of their adheſions to the tendinous plane, which dimiſhes in breadth and increaſes in thickneſs in proportion as it deſcends.

738. The external fleſhy plane is fixed in the ſame radiated manner to the inſide of the external lamina of the pericranium, from the great ſemicircular circumference, all the way to a ſmall portion of this lamina, more or leſs ſemicircular, above its inſertion in the zygomatic arch. Here the fleſhy fibres leave the external lamina, and the void ſpace thus formed between the ſmall ſemicircular portion, and the fleſhy fibres, is commonly filled with fat.

739. Through the whole extent of this inſertion the fleſhy fibres gradually contract, and adhere to the outſide of the middle tendinous plane in the ſame manner as the internal plane adheres to the other ſide, but in a contrary direction.

740. The middle tendinous plane continuing to contract by degrees, ends at length in a very conſiderable tendon, the extremity whereof, which is in a manner double, incloſes the coronoide apophyſis of the lower jaw, being ſtrongly inſerted in the edges and inſide thereof, and alſo a little in that part of the bone which lies between the two apophyſes. The internal portion of this inſertion is thicker, and has more fleſhy fibres than the external, which is almoſt wholly tendinous or aponeurotic.

741. There is another ſmall plane reckoned by ſome to be a portion of this muſcle, which in reality is no more than the third portion of this maſſeter, as may eaſily be perceived by ſawing off the zygomatic arch at the two ends, and then turning it down; for this ſmall muſcle parts from the temporalis without difficulty, and continues to adhere to the maſſeter.

§ 3. *Pterygoidæus Major ſive Internus.*

Situation in general. 742. This muſcle lies on the inſide of the lower jaw almoſt in the ſame manner as the maſſeter does on the outſide, being of the ſame figure with that muſcle, only ſmaller and narrower.

Inſertions. 743. It is fixed above in the pterygoide cavity, chiefly to the inſide of the external ala of the apophyſis pterygoides. This inſertion is wholly fleſhy, and from thence the muſcle has its name.

744. It runs down obliquely toward the angle of the lower jaw, and is inſerted a little tendinous in the inequalities on the inſide thereof, oppoſite to the inſertion of the maſſeter. It might be called *maſſeter internus.*

§ 4. *Pterygoidæus Minor ſive Externus.*

Situation in general. 745. This is an oblong fleſhy muſcle, much ſmaller than the other, and ſituated almoſt horizontally between the outſide of the apophyſis pterygoides, and the condyloide apophyſis of the lower jaw, the ſubject being conſidered in an erect poſture.

746. It is fixed by one extremity to the outſide and edge of the outer ala of the pterygoide apophyſis, filling the foſſula which is at the baſis of this apophyſis, near the baſis of the temporal apophyſis; of the ſphenoidal bone.

747. From thence it runs backward and a little outward, into the void ſpace between the two apophyſes of the lower jaw, and is inſerted interiorly in the condyloide apophyſis, at a ſmall foſſula immediately under the inner angle of the condyle. It is alſo fixed to the capſular ligament of the joint.

§ 5. *Digaſtricus.*

748. This is a ſmall long muſcle, ſituated laterally between the whole baſis of the jaw and the throat. It is fleſhy at both extremities and tendinous in the middle, as if it conſiſted of two ſmall muſcles joined

Situation in general.

joined endwiſe by a tendon, and from thence it is called *digaſtricus* in Greek, and *biventer* in Latin.

749. It is fixed by one fleſhy extremity in the ſulcus of the maſtoide apophyſis. From thence it runs forward, inclining towards the Os Hyoides, where the firſt fleſhy body ends in a round tendon, which is connected to the lateral part and root of the cornua of that bone by a kind of aponeurotic ligament, and not by a vagina or pulley, as appears at firſt ſight, becauſe of its paſſage by the extremity of the muſculus ſtylogloſſus, of which hereafter.

Inſertions.

750. Here the tendon is incurvated, and preſently ends in the other fleſhy body, which is fixed immediately above the internal labium of the baſis of the chin near the ſymphyſis, in a ſmall unequal depreſſion. This inſertion is broader than that of the other extremity. Sometimes the anterior inſertions of the two digaſtrici touch each other, and ſometimes ſeveral of their fibres croſs each other conſiderably.

ART. XVIII.

The muſcles which move the Os Hyoides.

751. THESE muſcles are nine in number, one anterior without a fellow, and eight lateral diſpoſed in four pairs, *viz.*

1. *Mylo-Hyoidæus.*
2. *Genio-Hyoidæus.*
3. *Stylo-Hyoidæus.*
4. *Omoplato-Hyoidæus.*
5. *Sterno-Hyoidæus.*

752. Theſe names are borrowed from the Greek, and expreſs the parts in which the muſcles are inſerted.

753. The Os Hyoides is likewiſe moved by the digaſtricus of the lower jaw; and it may in certain circumſtances be moved a little by ſome other muſcles, of which hereafter.

§ 1. *Mylo-Hyoidæus.*

754. This is a broad, thin, penniform muſcle, ſituated tranſverſely between the internal lateral

Situation in general.

parts of the baſis of the lower jaw, and lying on the anterior portions of the two digaſtric muſcles.

955. It is made up of two equal fleſhy portions, one lying on the right ſide, the other on the left, both in the ſame plane, and joined to a ſmall middle tendon, which is inſerted anteriorly in the middle of the baſis of the Os Hyoides, and from thence runs directly forward, diminiſhing gradually in its courſe. This is therefore a true digaſtric muſcle, and cannot be divided into two.

Structure and inſertions.

756. Each portion is fixed by fleſhy fibres to the internal lateral part of the lower jaw, between the oblique prominent line and the baſis, under the firſt four dentes molares, and caninus. The anterior and the greateſt part of the other fibres of each portion run obliquely from before backward, to the middle tendon, in which they are regularly fixed, the anterior fibres being the ſhorteſt, and a ſmall triangular void ſpace being formed between them, and the ſymphyſis of the chin.

757. The poſterior fibres of each portion which make about a fourth part of the whole, run likewiſe on each ſide to the baſis of the Os Hyoides, and are inſerted along the lower edge of its anterior or convex ſide, and from thence a little upward.

§ 2. *Genio-Hyoidæus.*

758. This is a ſmall and pretty long fleſhy muſcle, ſituated between the ſymphyſis of the chin and the Os Hyoides, cloſe by its fellow.

Situation in general.

759. It is fixed by its anterior extremity to a rough and ſometimes prominent ſurface, on the inner or poſterior ſide of the ſymphyſis of the lower jaw, a little above the chin. From thence it runs backward, and is inſerted anteriorly in the upper edge of the baſis of the Os Hyoides, having firſt ſent off a ſmall lateral portion which is fixed a little higher to the root of the cornu.

Inſertions.

760. This portion is diſtinguiſhed from the reſt by a nerve of the ninth pair; and it makes the muſcle appear a little oblique. The two genio-hyoidæi lie very cloſe together, ex-

cept at their upper edge, where they are a little ſeparated, but every where elſe they look as if they were but one muſcle.

§ 3. *Stylo-Hyoidæus.*

761. This is a ſmall fleſhy muſcle, lying obliquely between the apophyſis ſtyloides and Os Hyoides.

Situation in general.

762. It is fixed laterally by one extremity to the root or baſis of the apophyſis ſtyloides, and by the other to the Os Hyoides, at the place where the baſis and cornu unite, and likewiſe to the cornu itſelf, from whence it has been called *ſtylo cerato-hyoidæus.*

Inſertions.

763. The fleſhy fibres of this extremity are often parted, and incloſe the middle tendon of the digaſtricus.

§ 4. *Omoplato-Hyoidæus ſive Omo-Hyoidæus vulgo Coraco-Hyoidæus.*

764. This is a very long ſmall muſcle, much narrower than the ſterno-hyoidæus, and ſituated obliquely on the ſide of the neck or throat, between the ſcapula and Os Hyoides. It is a digaſtric muſcle, being divided into two fleſhy portions joined endwiſe to a ſhort middle tendon.

Situation in general.

765. It is commonly fixed by the lower extremity, to the ſuperior coſta of the ſcapula, between the ſmall notch and the angle, and ſometimes very near the angle, and from thence ſome anatomiſts have given it the barbarous name of *coſto-hyoïdæus.*

Inſertions.

766. From thence it paſſes over the coracoide apophyſis, adhering ſometimes to it by a kind of aponeuroſis or membranous ligament, and from this adheſion the name of *coraco-hyoidæus* was given it by ſome who had not diſcovered its main inſertion.

767. It is likewiſe often fixed to the clavicula by ligamentary or fleſhy fibres; and I have ſometimes ſeen it inſerted in the whole middle portion of that bone, being inſeparably united with the ſterno-hyoidæus. In one ſubject I found it to be a kind of biceps, one portion of it being fixed to the angle of the ſcapula, the other to the extremity of the clavicula.

768. Having paſſed the clavicle, it is bent forward, and runs between the ſterno-maſtoidæus, and internal jugular vein, the ſmall middle tendon being ſituated in this place. From thence it runs up to its inſertion in the inferior lateral part of the baſis of the Os Hyoides, near the cornu, and inſertion of the ſterno-hyoidæus which it covers a little.

§ 5. *Sterno Hyoidæus ſive Sterno-Cleido-Hyoidæus.*

Situation in general.

769. This is a long, thin, flat muſcle, broader at the lower than at the upper part, and ſituated, together with its fellow, on the foreſide of the throat, from whence ſome have very improperly termed it *muſculus bronchialis*.

Inſertions.

770. It is fixed by its lower extremity, in the ſuperior and lateral part of the inner or poſterior ſide of the ſternum, in the poſterior part of the ſternal extremity of the clavicula, in the tranſverſe ligament which connects theſe two bones, and in the inner or backſide of the cartilage of the firſt rib. All theſe other inſertions are more conſiderable than that in the ſternum, which is ſometimes ſcarce perceivable.

771. From thence it runs up on the foreſide of the aſpera arteria, joined to its fellow by a membrane which forms a ſort of linea alba, and is inſerted laterally in the lower edge of the baſis of the Os Hyoides.

772. There is ſometimes a tranſverſe tendinous line about the middle of the backſide of this muſcle.

773. According to the method commonly obſerved in complete treatiſes of myology, the following muſcles remain ſtill to be deſcribed, *viz.* The muſcles of the forehead, occiput, palpebræ, eye, external ear, noſe, lips, tongue, uvula, ductus Euſtachianus, pharynx, larynx, parts of generation, anus, and bladder; and to theſe we ought even to add the heart, as Mr. Cowper has done in the late edition of his Myotomy.

774. This method may be followed in treatiſes on the muſcles alone, in which all the parts that have any relation to them, are ſuppoſed to be known. But in a complete ſyſtem of anatomy, it it neither proper for beginners, nor even for thoſe who believe they have made a conſiderable progreſs in

this ſcience. For ſuch a treatiſe of all the muſcles of the body muſt be placed either before the deſcription of the viſcera and other particular organs, or after it.

775. If it goes before, we muſt be obliged to ſpeak of many parts altogether unknown, and thereby occaſion falſe ideas and dangerous miſtakes. If it comes after, the inconveniency will be equally great, it being impoſſible to give any true idea of many of the viſcera without a previous knowledge of the muſcles that lie near them; neither can the learner be made acquainted with theſe muſcles, till he knows the bones, cartilages, &c. which ſuſtain and ſurround them, as we ſhall ſee afterwards.

776. It may be objected, that I have here deſcribed the palmaris brevis, which is inſerted in no bone, and that I have omitted the muſcles of the bones of the ear, which are entirely fixed in bones. I have already anſwered the firſt objection, and the ſecond ſhall be anſwered in the proper place.

ART. XIX.

A compendious view of all the muſcles which are wholly inſerted in bones; with an enumeration of the bones in which each muſcle is inſerted.

Muſcles of the abdomen.

1. *Obliquus Externus.* THE fifth, ſixth, and ſeventh true ribs; ſeldom the fourth. All the falſe ribs. The Os Ilium. The Os Pubis.

2. *Obliquus Internus.* The ſixth and ſeventh true ribs, and their cartilages. All the falſe ribs and their cartilages. The laſt vertebra of the loins. The Os Ilium. The Os Pubis.

3. *Tranſverſalis.* The cartilages of the ſixth and ſeventh true ribs. The cartilages of all the falſe ribs. The three firſt vertebræ of the loins.

4. *Rectus.* The extremity of the body or ſecond bone of the ſternum. The cartilages of the fifth, ſixth, and ſeventh true ribs. The cartilage of the firſt falſe rib. The Os Pubis.

5. *Pyramidalis.* The Os Pubis.

Muſcles which move the bones of the ſhoulder on the trunk.

6. *Trapezius.* The Os Occipitis. The ſpinal apophyſes of all the vertebræ of the neck. The ſpinal apophyſes of all the vertebræ of the back. The ſcapula; its ſpine and acromium. The clavicle; its humeral portion.

7. *Rhomboides.* The two or three loweſt vertebræ of the neck; their ſpinal apophyſes. The three or four upper vertebræ of the back; their ſpinal apophyſes. The ſcapula; the ſub-ſpinal portion of the baſis.

8. *Angularis vulgo Levator Proprius.* The tranſverſe apophyſes of the four firſt vertebræ of the neck. The ſcapula; the ſuperior angle and ſupra-ſpinal portion of the baſis.

9. *Pectoralis Minor.* The ſecond, third, fourth, and fifth true ribs. The ſcapula; the coracoide apophyſes.

10. *Serratus Major.* The ſcapula; the whole baſis. All the true ribs. Sometimes one or two of the falſe ribs.

11. *Subclavius.* The firſt rib and its cartilage. The middle and ſternal portions of the clavicula.

Muſcles which move the Os Humeri on the ſcapula.

12. *Deltoides.* The ſcapula; the ſpine and acromium. The clavicula. The Os Humeri, under the channel of the biceps.

13. *Pectoralis Major.* The clavicula near the ſternum. The ſternum. All the true ribs. The firſt falſe rib, and ſometimes the ſecond. The Os Humeri, below the middle of the channel of the biceps.

14. *Latiſſimus Dorſi.* The ſix, ſeven, and ſometimes eight lower vertebræ of the back; the ſpinal apophyſes. All the vertebræ of the loins; the ſpinal apophyſes. The Os Sacrum. The Os Ilium. The four loweſt falſe ribs. The ſcapula; the inferior angle. The Os Humeri, near the upper part of the channel of the biceps.

15. *Teres Major.* The ſcapula; the inferior angle. The Os Humeri; about the middle of the channel of the biceps.

16. *Teres Minor.* The ſcapula; the inferior coſta. The Os Humeri; the inferior ſurface of the great tuberoſity of the head.

17. *Infra-Spinatus.* The ſcapula; the ſub-ſpinal cavity or foſſa. The Os Humeri; the middle part of the head.

18. *Supra-ſpinatus.* The ſcapula; the ſupra-ſpinal cavity or foſſa. The Os Humeri; the ſuperior part of the head.

19. *Subſcapularis*. The inſide of the ſcapula. The Os Humeri; the ſmall tuberoſity of the head.

20. *Coraco Brachialis*. The coracoide apophyſis of the ſcapula. The Os Humeri; the middle portion.

Muſcles which move the fore-arm upon the Os Humeri.

21. *Biceps*. The ſcapula; above the glenoide cavity, and at the coracoide apophyſis. The radius; at the tuberoſity.

22. *Brachialis*. The Os Humeri; below the inſertion of the deltoides. The ulna; below the coronoide apophyſis.

23. *Anconæus Major*. The ſcapula; at the lower part of neck. The ulna; at the top of the olecranum.

24. *Anconæus Externus*. The Os Humeri; below the great tuberoſity of the head. The ulna; at the olecranum.

25. *Anconæus Internus*. The Os Humeri; above the middle. The ulna; at the olecranum.

26. *Anconæus Minor*. The Os Humeri; at the external condyle. The ulna; the external oblong foſſula of the head.

Muſcles which move the radius on the ulna.

27. *Supinator Longus*. The Os Humeri at the criſta of the external condyle. The radius; near the ſtyloide apophyſis.

28. *Supinator Brevis*. The Os Humeri; at the lower part of the external condyle. The radius; the upper quarter of its inſide.

29. *Pronator Teres*. The Os Humeri; at the internal condyle. The radius; at the middle convex portion.

30. *Pronator Quadratus*. The ulna; at the long eminence of the lower extremity, The radius; at the broad ſurface of the lower extremity.

Muſcles which move the carpus on the fore-arm.

31. *Ulnaris Internus*. The Os Humeri; at the internal condyle. The ulna; at the olecranum, and almoſt the upper half of the bone. The Os Piſiforme. The Os Unciforme.

32. *Radialis Internus*. The Os Humeri; the inner condyle. The firſt bone of the metacarpus, and ſometimes the ſecond. The firſt phalanx of the thumb.

33. *Ulnaris Externus*. The Os Humeri; at the outer condyle. The fourth and ſometimes the third bone of the metacarpus. The firſt phalanx of the little finger; at the baſis.

34 *Radialis Externus Primus & Secundus*. The Os Humeri; at the outer condyle. The firſt and ſecond bones of the metacarpus.

35. *Ulnaris Gracilis vulgo Palmaris Longus.* The Os Humeri; at the inner condyle. The Os Scaphoides; ſometimes immediately, but moſt commonly by the intervention of the great annular ligament.

36. *Palmaris Cutaneus.* The aponeuroſis palmaris; but in no bone.

Muſcles which move the metacarpus.

37. *Metatarpius.* The Os Piſiforme. The fourth metacarpal bone.

Muſcles which move the fingers.

38. *Flexor Pollicis Longus.* The radius; the inſide. The third phalanx of the thumb.

39. *Extenſor Pollicis Primus.* The ulna; the outſide near the head. The radius; the middle portion of its outſide. The firſt and ſecond phalanges of the thumb.

40. *Extenſor Pollicis Secundus.* The ulna; the outſide, nearer the middle than the head. The radius; the outſide, between the middle and the lower extremity. The third phalanx of the thumb.

41. *Thenar.* The Os Trapezium. The head of the firſt, and the baſis of the ſecond phalanx of the thumb.

42. *Meſothenar.* The firſt metacarpal bone; the body. The ſecond metacarpal bone, near the head. The head of the firſt, and the baſis of the ſecond phalanx of the thumb.

43. *Antithenar.* The firſt bone of the metacarpus; near the baſis. The firſt phalanx of the thumb near the head.

44. *Perforatus.* The ulna; near the head, and the inſide. The radius in the ſame manner. The ſecond phalanges of the four fingers; the flat ſides.

45. *Perforans.* The ulna; the inſide, from the head to the lower third part of the bone. The third phalanges of the four fingers; the flat ſides.

46. *Extenſor Digitorum.* The Os Humeri; the external condyle. The radius; ſometimes a little The firſt and third phalanges of the four fingers; the convex ſides.

47. *Extenſor Indicis Proprius.* The ulna; the inſide, between the middle and the lower extremity. The firſt and third phalanx of the index; the convex ſide.

48. *Extenſor Minimi Digiti Proprius.* The upper half of the ulna; the inſide. The phalanges of the little finger; the convex ſides.

49. *Lumbricales.* The tendons of the perforatus. The firſt and third phalanges; the convex ſides.

50 *Interoſſei Externi*. The bones of the metacarpus; near their convex ſides. The firſt and third phalanges; the convex ſides.

51. *Interoſſei Interni*. The bones of the metacarpus, the outer and inner ſides. The firſt and third phalanges.

52. *Semi-Interoſſeus Indicis*. The firſt phalanx of the thumb; the outſide of the baſis. The Os Trapezium. The firſt phalanx of the index; near the head.

53. *Hypothenar Minor*. The Os Piſiforme. The firſt phalanx of the little finger.

Muſcles which move the Os Femoris on the Pelvis.

54. *Pſoas ſive Lumbaris Internus*. The laſt vertebra of the back; the body and tranſverſe apophyſis. All the vertebræ of the loins; in the ſame manner The Os Femoris; the little trochanter.

55. *Iliacus*. The Os Ilium; the criſta, anterior ſpines, the ſpace between theſe, and the inſide of the bone. The Os Sacrum; the part of its concave ſide neareſt the Os Ilium. The Os Femoris; the trochanter minor.

56. *Pectineus*. The Os Pubis; the criſta; the Os Femoris; below the little trochanter.

57. *Glutæus Maximus*. The Os Ilium; the criſta and tuberoſity. The Os Sacrum; the lateral part of the convex ſide. The Os Coccygis; in the ſame manner. The Os Femoris; the long impreſſion below the great trochanter.

58 *Glutæus Minimus* The Os Ilium; the outſide between the great and ſmall ſemicircular impreſſions. The Os Iſchium; the ſpine. The Os Femoris; the upper part of the trochanter major.

59. *Triceps Primus*. The Os Pubis; the tuberoſity or ſpine, and the ſymphyſis. The Os Femoris; the middle part of the linea aſpera.

60. *Triceps Secundus*. The Os Pubis; the inferior ramus. The Os Femoris; the upper part of the linea aſpera.

61. *Triceps Tertius* The Os Iſchium; the ſmall ramus, and the tuberoſity. The Os Femoris; the middle part of the linea aſpera, and ſomething more, and the tuberoſity of the inner condyle.

62. *Pyriformis*. The Os Ilium; the poſterior ſinus. The Os Sacrum the lateral part. The Os Femoris; the upper part of the great trochanter.

63. *Obturator Internus*. The Os Ilium. The Os Pubis. The Os Iſchium; the inſides of theſe three bones, near the foramen ovale, and great ſinus. The Os Femoris; near the upper part of the cavity of the great trochanter.

64. *Gemelli*. The Os Iſchium; the ſpine, notch, and tuberoſity. The Os Femoris: about the middle of the cavity of the great trochanter.

65. *Obturator Externus*. The Os Pubis; the inſide all the way to the foramen ovale. The Os Iſchium; the edge of the foramen ovale. The Os Femoris, the middle of the cavity of the great trochanter.

66. *Quadratus*. The Os Iſchium; between the acetabulum and the tuberoſity. The Os Femoris; the lower half of the oblong eminence of the trochanter major.

67. *Muſculus Faſciæ Latæ*. The Os Ilium; the ſuperior anterior ſpine. The Os Femoris; below the great trochanter.

Muſcles which move the leg on the Os Femoris.

68. *Rectus Anterior*. The Os Ilium; the ~~ſup~~inferior anterior ſpine, and ſuperior part of the ſupercilium acetabuli. The patella; the upper edge.

69. *Vaſtus Externus*. The Os Femoris; the poſterior rough ſurface of the great trochanter. The patella; the outer edge. The tibia; the outſide of the head.

70. *Vaſtus Internus*, The Os Femoris; the interior rough ſurface of the great trochanter. The patella; the inſide. The tibia; the inſide of the head.

71. *Crureus*. The Os Femoris; along the foreſide. The patella; the upper edge.

72. *Sartorius*. The Os Ilium; the ſuperior anterior ſpine. The tibia; the inner and fore part of the head.

73. *Gracilis Internus*. The Os Pubis; the ſmall ramus near the ſymphyſis. The tibia; the inner and fore part of the head, below the inſertion of the ſartorius.

74. *Biceps*. The Os Iſchium: the poſterior and lower part of the tuberoſity. The Os Femoris; the lower half of the linea aſpera. The head of the fibula.

75. *Semi-nervoſus*. The Os Iſchium; the upper and poſterior part of the tuberoſity. The tibia; the inſide of the upper extremity, below the inſertion of the gracilis internus.

76. *Semi-membranoſus*. The Os Iſchium; the bony line

between the acetabulum and the tuberoſity. The tibia; the poſterior impreſſion of the inner condyle.

77. *Popliteus.* The Os Femoris; the outer edge of the external condyle. The tibia; the oblique line on the backſide of the head.

Muſcles which move the tarſus on the leg.

78. *Tibialis Anticus.* The tibia; the upper third part of the criſta, and the upper two thirds of the outer flat ſide. The Os Cuneiforme Majus; the inſide. The firſt bone of the metatarſus; the inſide.

79. *Peronæus Medius,* The fibula; the outer or anterior ſide. The fifth bone of the metatarſus; the tuberoſity of the baſis.

80. *Peronæus Minimus.* The fibula; the lower half of the inſide, between the two oblique lines. The fifth bone of the metatarſus, above and near the baſis.

81. *Gaſtrocnemii.* The Os Femoris; above the condyles, and behind their lateral tuberoſities. The Os Calcis; the poſterior extremity.

82. *Soleus.* The tibia; the backſide from the ſuperior oblique line, to the middle of the bone. The fibula; more than the upper third part of the backſide. The Os Calcis; the poſterior extremity.

83. *Tibialis Gracilis, vulgo Plantaris.* The Os Femoris; the outer edge of the external condyle. The Os Calcis; the poſterior extremity, near the inner edge.

84. *Tibialis Poſticus.* The tibia; the upper part of the backſide. The fibula; the upper half of the internal angle. The Os Scaphoides; the tuberoſity or lower part.

85. *Peronæus Maximus.* The tibia; near its articulation with the fibula on the foreſide. The fibula; the outer and foreſide of the head and neck, and the upper half of the external angle. The Os Cuneiforme Majus; a little toward the lower part. The firſt bone of the metatarſus; the lateral impreſſion of the baſis.

Muſcles which move the metatarſus and toes.

86. *Extenſor Pollicis Longus.* The tibia; near the lower extremity, toward the fibula. The fibula; the upper three fourth parts. The firſt and ſecond phalanges of the great toe; the baſes.

87. *Flexor Pollicis Longus.* The fibula; the lower half of the

the backſide. The ſecond phalanx of the great toe; the under ſide.

88. *Thenar.* The Os Calcis; the lower part. The Os Scaphoides; the lower part. The Os Cuneiforme Majus; the lower part. The firſt phalanx of the great toe; the inſide. The internal ſeſamoide bone.

89. *Antithenar.* The ſecond, third, and fourth bones of the metatarſus; near their baſes. The firſt phalanx of the great toe; the outſide. The external ſeſamoide bone.

90. *Extenſor Digitorum Longus.* The tibia; the outſide of the head. The fibula; the upper three fourths of the inſide. The four ſmall toes; along their upper ſides.

91. *Extenſor Digitorum Brevis.* The aſtragalus; the upper ſide of the anterior apophyſis. The firſt phalanx of the great toe; the upper ſide. The three following toes, rarely the fifth; the upper ſides of all the phalanges.

92. *Flexor Digitorum Brevis.* The Os Calcis; the lower and foreſide of the great tuberoſity. The ſecond phalanges of the four ſmall toes; the inner part of the under ſide.

93. *Flexor Digitorum Longus.* The tibia; a little more than the middle third part of the backſide. The third phalanges of the four ſmall toes; the under ſide.

94. *Flexor Digitorum Acceſſorius.* The Os Calcis; the eminences of the lower ſide.

95. *Lumbricales.* The firſt phalanges of the toes, laterally.

96. *Tranſverſalis Pedis.* The laſt three bones of the metatarſus; the lower ſides of the heads, by the intervention of the interoſſeous ligaments. The firſt phalanx of the great toe; the outſide of the baſis.

97. *Interoſſei Superiores.* The five bones of the metatarſus; near their upper ſides. The firſt phalanx of the ſecond toe; the outer and inner ſides. The third and fourth toes; the outſides.

98. *Interoſſei Inferiores* Four bones of the metatarſus; toward the under ſides, The firſt phalanges of the laſt three toes; the inſides.

99. *Metarſius.* The Os Calcis; the great inferior tuberoſity. The fifth bone of the metatarſus; the under ſide.

100. *Parathenar Major.* The Os Calcis; the outer part of the lower ſide. The firſt phalanx of the little toe; the under ſide.

101. *Parathenar Minor.* The fifth bone of the metatarſus; the under part of the outſide. The firſt phalanx of the little toe; the under ſide of the baſis.

Muſcles employed in reſpiration.

102. *Diaphragma.* The ſternum; the appendix enſiformis. All the ribs; their bony extremities and cartilages, and almoſt all the laſt falſe rib. The laſt vertebra of the back; the body. The firſt three or four vertebræ of the loins; the bodies.

103. *Scaleni.* All the vertebræ of the neck; the tranſverſe apophyſes. The firſt two ribs; the middle and poſterior part of the convex ſide.

104. *Serratus Poſticus Superior.* The laſt two vertebræ of the neck; the ſpinal apophyſes. The firſt two vertebræ of the back; in the ſame manner. The ſecond, third, fourth, and ſometimes the fifth true ribs; near the angles.

105. *Serratus Poſticus Inferior.* The laſt vertebra of the back; the ſpinal apophyſis. The firſt three vertebræ of the loins; the ſpinal apophyſes. The laſt four falſe ribs.

106. *Intercoſtales.* All the ribs and their cartilages; the edges.

107. *Supra-Coſtales.* The laſt vertebra of the neck; the tranſverſe apophyſis. All the vertebræ of the back, except the laſt; in the ſame manner. All the ribs; the poſterior part of the outſide.

108. *Sub-Coſtales.* The true ribs, from the fourth downward; the concave or inſides. The falſe ribs from the fourth upward; in the ſame manner.

109. *Sterno-Coſtales.* The ſternum; the edge of the lower half of the inſide. The ſecond, third, fourth, fifth, and ſixth true ribs; the cartilages near the bony portions.

Muſcles which move the head on the trunk.

110. *Sterno-Maſtoidæus.* The ſternum; the upper edge; near the clavicular notch. The clavicula; near the ſternal extremity. The maſtoide apophyſis; the upper and back part.

111. *Splenius.* The Os Occipitis; the lateral crooked portion of the tranſverſe line. The maſtoide apophyſis; the upper part. The firſt three or four vertebræ of the neck; the tranſverſe and ſpinal apophyſes. The firſt three or more vertebræ of the back; the ſpinal apophyſes.

112. *Complexus Major.* The firſt vertebra of the neck; backward near the tranſverſe apophyſis. The ſix following

vertebræ; the tranſverſe apophyſes. The Os Occipitis; the poſterior portion of the ſuperior tranſverſe line.

113. *Complexus Minor.* The ſix lower vertebræ of the neck; the tranſverſe apophyſes. The maſtoide apophyſis; poſteriorly.

114. *Rectus Major.* The ſecond vertebra of the neck; the ſpinal apophyſis. The Os Occipitis; the poſterior part of the inferior tranſverſe line.

115. *Rectus Minor.* The firſt vertebra of the neck; the poſterior tubercle. The Os Occipitis; below the poſterior part of the lower tranſverſe line, in a foſſula near the criſta.

116. *Obliquus Superior.* The firſt vertebra of the neck; the extremity of the tranſverſe apophyſis. The Os Occipitis; the middle portion of the inferior tranſverſe line.

117. *Obliquus Inferior.* The firſt vertebra of the neck; the tranſverſe apophyſis. The ſecond vertebra; the ſpinal apophyſis.

118. *Rectus Anticus Longus.* The third, fourth, fifth, and ſixth vertebræ of the neck; the forepart of the tranſverſe apophyſes. The Os Occipitis; the lower and anterior part of the apophyſis baſilaris.

119. *Rectus Anticus Brevis.* The firſt verebra of the neck on one ſide of the anterior middle eminence. The Os Occipitis; the apophyſis baſilaris; a little more forward than the condyle.

120. *Tranſverſalis Anticus Primus.* The firſt vertebra of the neck; the foreſide of the tranſverſe apophyſis. The baſis of the occipital bone; below the edge of the jugular foſſula.

121. *Tranſverſalis Anticus Secundus.* The ſecond vertebra of the neck; the middle of the tranſverſe apophyſis, anteriorly. The firſt vertebra; the baſis of the tranſverſe apophyſis, anteriorly.

122. *Muſculi Acceſſorii.* The baſis of the Os Occipitis. The firſt two vertebræ of the neck.

Vertebral muſcles in general.

The ſeveral claſſes of the vertebral muſcles are theſe. (1.) Spinales ſimplices. (2.) Spinales compoſiti. (3.) Tranſverſales ſimplices. (4.) Tranſverſales compoſiti. (5.) Spino-tranſverſales. (6.) Tranverſo-ſpinales. (7.) Obliqui, which go from one tranſverſe, to ſeveral ſpinal apophyſes. (8.) Obliqui, which go from ſeveral tranſverſe, to one ſpinal apophyſis.

Vertebral muſcles in particular.

123. *Longus Colli.* The firſt vertebra of the neck; the middle tubercle. The three following vertebræ; the bodies anteriorly. The ſecond third, fourth, fifth, and ſixth vertebræ of the neck; the bodies near the tranſverſe apophyſes, and theſe apophyſes anteriorly. The laſt vertebra of the neck; the anterior lateral part of the body. The firſt three, and ſometimes the fourth vertebra of the back, in the ſame manner.

124. *Tranſverſalis Colli Major.* All the vertebræ of the neck; the tranſverſe apophyſes. The firſt four, five, or ſix vertebræ of the back, in the ſame manner.

125. *Tranſverſalis Colli Minor.* On one ſide of the tranſverſalis major.

126. *Semi-Spinalis.* All the vertebræ of the neck, except the firſt. The ſix upper vertebræ of the back, or more.

127. *Spinales Colli Minores.* All the vertebræ of the neck, except the firſt; the ſpinal apophyſes. The firſt vertebra of the back; in the ſame manner.

128. *Tranſverſales Colli Minores.* The vertebræ of the neck; the tranſverſe apophyſes. The firſt vertebra of the back; the ſpinal apophyſis.

129. *Sacro-Lumbaris.* The vertebræ of the neck; the tranſverſe apophyſes. The ribs; the angular marks. The Os Sacrum; the ſuperior ſpines, and contiguous lateral parts. The Os Ilium; the poſterior portion of the criſta and the tuberoſity.

130. *Longiſſimus Dorſi.* The laſt vertebra of the neck; the tranſverſe apophyſis. The firſt ſeven vertebræ of the back; the tranſverſe apophyſes. The laſt vertebra of the back; the ſpinal apophyſis. All the vertebræ of the loins; the ſpinal apophyſes. The Os Sacrum; the ſuperior ſpines, and upper lateral part. All the true ribs; the tuberoſities. All the falſe ribs; between the tuberoſities and the angular marks.

131. *Spinalis Dorſi Major.* All the vertebræ of the back, except the firſt, and ſometimes the ſecond; the ſpinal apophyſes. The firſt and ſometimes the ſecond vertebra of the loins; the ſpinal apophyſes.

132. *Spinales Dorſi Minores.* All the vertebræ of the back; the ſpinal apophyſes. The firſt vertebra of the loins; in the ſame manner.

133. *Tranſverſalis Dorſi Major.* Vide Longiſſimus dorſi.

134. *Tranſverſales Dorſi Minores.* The vertebræ of the back; the tranſverſe apophyſes.

135. *Semi-Spinalis Dorſi.* The vertebræ of the back; the twelve ſpinal, and ten loweſt tranſverſe apophyſes. The firſt three vertebræ of the loins; the tranſverſe apophyſes.

136. *Semi-ſpinalis Lumborum.* The three loweſt vertebræ of the loins; the tranſverſe and articular apophyſes. The Os Sacrum; the ſuperior lateral parts. The Os Ilium; the ſuperior poſterior ſpine.

137. *Quadratus Lumborum.* The laſt falſe rib. The vertebræ of the loins, the tranſverſe apophyſes. The Os Sacrum; the upper lateral part. The Os Ilium; almoſt the poſterior half of the criſta.

138. *Spinales et Tranſverſales Lumborum.* The Os Sacrum; the ſuperior ſpines. The vertebræ of the loins; the ſpinal and tranſverſe apophyſes.

139. *Coccygæus Anterior.* The Os Ilium; the inſide. The Os Iſchium; the inſide of the body of the bone, behind the foramen ovale. The Os Coccygis; the lateral and lower part of the inſide.

140. *Coccygæus Poſterior.* The Os Sacrum; the foreſide of the firſt two vertebræ. The Os Iſchium; the inſide of the ſpine. The Os Coccygis; the lateral middle part of the inſide.

141. *Pſoas Parvus.* The laſt vertebra of the back, or firſt of the loins, or both; the tranſverſe apophyſes. The Os Pubis; the criſta.

Muſcles which move the lower jaw.

142. *Maſſeter.* The Os Temporum; the zygomatic apophyſis. The Os Maxillare; near the Os Malæ. The Os Malæ; the lower edge; the lower jaw; at the angle, above the angle, and at the root of the coronoide apophyſis; all on the outſide.

143. *Temporalis.* The Os Frontis; the outſide, behind the angular apophyſis. The Os Parietale; the outſide, between the ſemicircular impreſſion, and the ſquammous ſlope. The Os Temporum; the outſide of the ſquammous portion.

The Os Sphenoidale; the outſide of the great temporal ala. The Os Malæ; the zygomatic foſſa. The maxilla inferior; the coronoide apophyſis.

144. *Pterygoidæus Internus.* The Os Sphenoides; the Pterygoide apophyſis, at the inſide of the external ala. The maxilla inferior; the inſide near the angle.

145. *Pterygoidæus Externus.* The Os Sphenoidale; the apophyſis pterygoides, at the outſide of the external ala. The maxilla inferior; the foſſula of the condyloide apophyſis.

146. *Digaſtricus.* The Os Temporum; the maſtoide ſulcus. The lower jaw; the inner labium of the baſis of the chin. The Os Hyoides; the lateral part.

Muſcles which move the Os Hyoides.

147. *Mylo Hyoidæus.* The maxilla inferior; the inſide, above the oblique prominent line. The Os Hyoides; the baſis, anteriorly.

148. *Genio-Hyoidæus.* The maxilla inferior; the inſide of the chin, at the inferior rough impreſſion, near the ſymphyſis. The Os Hyoides; the upper part of the baſis anteriorly, and the root of the cornu.

149. *Stylo-Hyoidæus.* The Os Temporum; the baſis of the apophyſis ſtyloides. The Os Hyoides; the lateral part of the baſis, and the ſymphyſis of the cornu.

150. *Omo-Hyoidæus.* The ſcapula; the ſuperior coſta, and ſometimes the coracoide apophyſis. The Os Hyoides; the lateral inferior part of the baſis, near the cornu.

151. *Sterno-Hyoidæus.* The ſternum; the upper part toward the inſide, near the notch. The clavicula ſometimes; the ſternal extremity. The Os Hyoides; the lower edge of the baſis.

× ſterno mastoideus. Innis

ART. XX.

An enumeration of the bones mentioned in the deſcription of the muſcles; and of the muſcles inſerted in each bone.

1. *Os Frontis.* Temporalis. 2. *Os Parietale.* Temporalis.

3. *Os Temporum.* Temporalis. Maſſeter. Digaſtricus. Stylo-hyoidæus. Sterno-maſtoidæus. Splenius. Complexus minor.

4. *Os Sphenoidale.* Temporalis. Pterygoidæus externus. Pterygoidæus internus.

5. *Os Occipitis.* Splenius. Complexus major. Complexus minor. Rectus major poſticus. Rectus minor poſticus. Obliquus minor. Sterno-maſtoidæus. Rectus anticus longus. Rectus anticus brevis. Tranſverſalis anticus primus. Trapezius ſcapulæ.

6. *Os Malæ.* Temporalis. Maſſeter.

7. *Maxilla Inferior.* Maſſeter. Temporalis. Pterygoidæus internus. Pterygoidæus externus. Digaſtricus. Genio-hyoidæus. Mylo-hyoidæus.

8. *Os Hyoides.* Stylo-Hyoidæus. Genio-hyoidæus. Mylo-hyoidæus, Omo-hyoidæus. Sterno-hyoidæus.

9. *Vertebræ Colli.* Splenius. Complexus Major. Complexus minor. Rectus major poſticus. Rectus minor poſticus. Obliquus ſuperior. Obliquus inferior. Rectus anticus longus. Rectus anticus brevis. Tranſverſalis anticus primus. Tranſverſalis anticus ſecundus. Longus colli. Tranſverſalis major colli. Tranſverſalis gracilis colli. Semi-ſpinalis colli. Spinales colli minores. Tranſverſales colli minores. Scaleni. Trapezius ſcapulæ. Rhomboides. Angularis. Longiſſimus dorſi. Serratus ſuperior poſticus. Sacro-lumbaris. Supra coſtales.

10. *Vertebræ Dorſi.* Trapezius. Latiſſimus dorſi. Rhomboides. Serratus ſuperior poſticus. Splenius. Complexus major. Complexus minor. Longus colli. Tranſverſalis colli major. Tranſverſalis colli gracilis. Semi-ſpinales colli. Tranſverſalium colli minorum unus. Sacro-lumbaris. Lon-

giſſimus dorſi. Longiſſimi dorſi acceſſorius. Spinalis dorſi major. Tranſverſalis dorſi major. Tranſverſales dorſi minores. Supra-coſtales. Semi-ſpinalis dorſi. Diaphragma. Serratus poſticus inferior. Pſoas major. Pſoas parvus. Pſoas parvus acceſſorius.

11. *Vertebræ Lumborum.* Tranſverſalis abdominis. Latiſſimus dorſi. Quadratus lumborum. Lumbaris externus minor. Diaphragma. Semi-ſpinalis lumborum. Spinales lumborum. Pſoas Parvus. Serratus inferior poſticus,

12. *Os Sacrum.* Latiſſimus dorſi, Sacro Lambaris. Longiſſimus dorſi. Semi-ſpinalis lumborum. Spinalium & tranſverſalium lumborum unus. Sacro-coccygæus. Glutæus maximus.

13. *Os Coccygis.* Sacro coccygæus. Iſchio-coccygæus. Glutæus maximus.

14. *Sternum.* Sterno-maſtoidæus. Sterno-hyoidæus. Subclavius. Pectoralis major. Sterno-coſtales. Diaphragma. Tranſverſalis abdominis. Rectus abdominis.

15. *Coſtæ.* Supra-coſtales. Inter coſtales. Sub coſtales. Sterno-coſtales. Scaleni. Serratus poſticus ſuperior. Serratus poſticus inferior. Sacro-lumbaris. Longiſſimus dorſi. Diaphragma. Quadratus lumborum. Subclavius. Pectoralis minor. Pectoralis major. Serratus major. Latiſſimus dorſi. Obliquus externus abdominis. Obliquus internus abdominis. Tranſverſalis abdominis. Rectus abdominis.

16. *Os Ilium.* Obliquus externus abdominis. Obliquus internus abdominis. Tranſverſalis abdominis. Latiſſimus dorſi. Sacro-lumbaris. Longiſſimus dorſi. Quadratus lumborum. Iliacus Glutæus maximus. Glutæus medius. Glutæus minimus. Pyriformis. Obturator internus. Muſculus faſciæ latæ. Sartorius. Rectus Gracilis.

17. *Os Pubis.* Obliquus abdominis externus. Obliquus internus abdominis. Tranſverſalis abdominis (*ſometimes.*) Rectus abdominis. Pyramidalis abdominis. Pſoas parvus. Pectineus. Obturator externus. Obturator internus. Rectus ſive gracailis internus. Triceps primus. Triceps ſecundus.

18. *Os Iſchium.* Coccygæus anterior. Obturator internus Gemelli. Obturator externus. Quadratus femoris. Triceps ſecundus (*ſometimes*). Tricepes tertius. Biceps tibiæ. Semi-nervoſus. Semi-membranoſus,

19. *Scapula.* Omo-hyoidæus. Trapezius. Rhomboides. Angularis. Pectoralis minor. Serratus major. Supra-ſpinatus. Infra-ſpinatus. Teres major. Teres minor. Subſcapularis. Latiſſimus dorſi. Biceps. Anconæus maximus. Deltoides.

20. *Clavicula.* Sterno-maſtoidæus. Sterno hyoidæus. Trapezius. Subclavius. Deltoides. Pectoralis major.

21. *Os Humeri.* Deltoides. Pectoralis major. Latiſſimus dorſi. Teres major. Supra-ſpinatus. Infra-ſpinatus. Biceps. Brachialis. Anconæus externus. Anconæus internus. Anconæus minimus. Ulnaris internus. Radialis internus. Ulnaris gracilis. Ulnaris externus. Radialis externus. Supinator longus. Supinator brevis. Pronator teres. Extenſor digitorum communis.

22. *Ulna.* Brachialis. Anconæus major. Anconæus externus. Anconæus internus. Anconæus minor. Pronator quadratus. Ulnaris internus. Ulnaris externus. Extenſores pollicis. Perforatus. Perforans. Extenſor indicis proprius. Extenſor minimi digiti proprius.

23. *Radius.* Biceps. Supinator longus. Supinator brevis. Pronator teres. Pronator quadratus. Ulnaris externus (*in the annular ligament at the head of the radius*). Flexor pollicis longus. Perforatus. Extenſor digitorum communis.

24. *Os Piſiforme & Unciforme.* Ulnaris internus.

25. *Os Scaphoides.* Ulnaris gracilis ſive palmaris longus.

26. *Os Naviculare Magnum & Trapezoides.* Interoſſei.

27 *Bones of the Metacarpus.* Interoſſei. Radialis externi. Meſothenar. Metacarpius. Hypothenar minor.

28. *Firſt phalanx of the thumb.* Extenſor pollicis primus, Thenar. Meſothenar. Antithenar.

29. *Second phalanx of the thumb.* Extenſor pollicis primus & ſecundus. Thenar, Meſothenar.

30. *Third phalanx of the thumb.* Flexor pollicis longus.

31. *Firſt phalanges of the fingers.* Extenſor digitorum communis. Interoſſei.

32. *Second phalanges of the fingers.* Perforatus.

33. *Third phalanges of the fingers.* Extenſor digitorum communis. Perforans.

34. *Index.* Extenſor indicis proprius.

35. *Little finger.* Extenſor minimi digiti proprius.

36. *Os Femoris.* Pſoas. Iliacus. Pectineus. Glutæus maximus. medius, & minimus. Muſculus faſciæ latæ. Triceps primus, ſecundus, & tertius. Vaſtus externus. Vaſtus internus. Crureus. Biceps. Popliteus. Gaſtrocnemii. Tibialis gracilis.

37. *Patella.* Vaſtus Externus. Vaſtus internus. Crureus. Rectus anterior.

38. *Tibia.* Vaſtus externus. Vaſtus internus. Rectus anterior. Semi membranoſus. Semi nervoſus. Gracilis internus. Sartorius. Popliteus. Tibialis anticus. Extenſor pollicis longus. Extenſor digitorum longus. Soleus. Tibialis poſticus. Peronæus longus. Flexor digitorum longus.

39. *Fibula.* Biceps. Peronæus medius. Peronæus minimus. Soleus. Peronæus longus. Extenſor pollicis longus. Flexor pollicis longus. Extenſor digitorum longus.

40. *Aſtragalus.* Extenſor digitorum brevis.

41. *Os Calcis.* Gaſtrocnemii. Soleus. Tibialis gracilis. Tibialis poſticus. Thenar. Perforatus ſive flexor digitorum brevis. Flexor digitorum acceſſorius. Metatarſius. Parathenar major.

42. *Os Scaphoides.* Tibialis poſticus thenar.

43. *Os Cuneiforme Majus.* Tibialis anticus. Peronæus maximus. Thenar.

44. *Bones of the metatarſus.* Tibialis anticus. Peronæus maximus. Antithenar. Tranſverſalis pedis. Interoſſei. Peronæus medius. Peronæus minimus. Metatarſius. Parathenar minor.

45. *Bones of the great toe.* Extenſor pollicis longus. Extenſor pollicis brevis. Tranſverſalis pedis. Thenar. Antithenar. Flexor pollicis longus.

46. *Bones of the ſmall toes.* Flexor digitorum longus. Interoſſei. Flexor digitorum brevis. Parathenar major. Extenſor digitorum longus. Extenſor digitorum brevis.

ART. XXI.

The particular uſes of the muſcles which are wholly inſerted in bones.

777. I Obſerved in the beginning of this ſection, N° 34. that the uſe of each muſcle in particular, is confined to the motion of one or more moveable parts; and that ſome parts require a certain number of muſcles to move them, whereof ſome act one way and ſome another. Several muſcles, for inſtance, move the Os Humeri upon the ſcapula, and of theſe ſome raiſe, others depreſs it; ſome turn it forward, ſome backward, and others round its axis, *&c.*

778. I took notice, N° 37, of the inconveniencies of the common language of anatomiſts, with reſpect to the names of many muſcles; with reſpect to the uſes attributed to them, they being limited to theſe, as if they could not have any other; and with reſpect to the bones, the changes of ſituation of which are confined to the action of a certain number of muſcles, as if no other muſcles were capable of producing them.

779. I remarked, N° 38. 39. that in order to ſhun theſe inconveniencies, it would be proper to diſtribute and enumerate the muſcles in another manner than is commonly done. Thus, for inſtance, inſtead of this title: *The muſcles of the arm*, I would put the following: *The muſcles which move the Os Humeri on the ſcapula, and the ſcapula on the Os Humeri.* But leſt ſuch titles might be reckoned too long, I have omitted the reciprocal motions, mentioning them only in the deſcription of each muſcle; and there I have likewiſe pointed out the other muſcles which may have the ſame uſes with thoſe I treat of; and alſo the other uſes which theſe muſcles may have. The muſcles which may move certain bones without being inſerted in them, I term *aſſiſtant* or *auxiliary* muſcles.

780. Before we enter upon the detail of theſe particular uſes, it is likewiſe proper to call to mind what I ſaid N° 41. 42. 43. concerning the congeneres and antagoniſt muſcles; concerning ſimple and direct motions; and thoſe that are

combined or compounded; concerning tonic motions; concerning the co-operation of muſcles; and concerning the diſtinction of principal movers, moderators, and directors.

781. It will not be amiſs to repeat here what I ſaid N°. 56. and 58. that in order to comprehend all the uſes and contrivances of each muſcle in particular, we ought to examine its place or ſituation in general, its external conformation, ſtructure, or compoſition, particular ſituation, direction, lateral connections; how it is diſpoſed with reſpect to the neighbouring muſcles, for the production of ſimple motions; and with reſpect to the muſcles at a greater diſtance, for the production of compound motions; and laſtly, with reſpect to the bones, as a moving power, applied to the different kinds of levers.

782. Theſe inquiries very neceſſary for philoſophical reaſonings, phyſical preſcriptions, and chirurgical operations, will be very much facilitated by the help of the two foregoing tables; in the firſt of which we ſee at one view, in what bones, in how many bones, and in what parts of bones, each muſcle is inſerted; and in the ſecond, to what muſcles, and to what number of muſcles, each bone gives inſertions.

783. But to make a due uſe of theſe two tables, we ought to be previouſly acquainted with the articulations of bones, eſpecially thoſe of freſh ſubjects, and from thence be able exactly to determine in how many different directions each bone is capable of being moved. We ought likewiſe to know not only the general direction of each muſcle, but alſo all the poſſible ſituations or different attitudes of the bones in which each muſcle is inſerted.

784. The experiments made on dead bodies, by pulling the muſcles after they have been raiſed, are very fallacious; eſpecially in the long muſcles parted from all their lateral connections; and ſtill more when the natural direction of theſe muſcles is oblique, or when they are naturally deſigned for oblique motions; not to mention how much, by this way of management, a diſſected muſcle may be increaſed in length. We have inſtances of ſuch miſtakes in the ſterno-maſtoidæus, ſupinator longus, ſartorius, peronæus longus, *&c.* as we ſhall ſee hereafter.

785. The terms of raiſing, depreſſing, bringing forward, backward, *&c.* uſed here, are to be conſidered as applied to

the ſubject, in an erect poſture; and I underſtand by them not only the effects of a real motion, or a real change of ſituation; but alſo the force employed to keep any part in the ſame ſituation againſt a reſiſtance or contrary force.

786. Thus when I ſay that the biceps bends the fore-arm, I mean likewiſe that its action tends to preſerve that part in any given ſituation againſt a contrary force applied to extend it; and we ſee from experience, that in theſe kinds of efforts, without any real motion, in proportion as the reſiſtance increaſes, the muſcle grows ſtiffer or harder, without producing any change of place.

§ 1. *Uſes of the muſcles which move the bones of the ſhoulder on the trunk.*

787. The mechaniſm of the ſcapula in relation to its motions and changes of ſituation, is very different from that of all the other bones of the body, except the Os Hyoides, of which I ſhall ſpeak hereafter. All the other bones have ſolid fulcra or fixed points, on which they are either moved or fixed by the muſcles; but the motions of the ſcapula, its changes of ſituation, and its continuance in any one given attitude, are brought about without the help of any ſolid fulcrum. The muſcles alone ſuſtain it and brace it down, in all its different motions and ſituations.

788. The ſcapula has this peculiarity likewiſe belonging to it, that it is the fulcrum and baſis of all the motions of the Os Humeri, of ſome motions of the fore-arm; and even of all the moſt violent efforts made with theſe bones; without being itſelf either moved or fixed on any ſolid baſis.

789. We ought not here to have any regard to the clavicula, which ſeems to be only a kind of os acceſſorium in men, and ſuch other animals as can turn their fore-feet forward, to lay hold of any thing, almoſt in the ſame manner as we turn the hand in ſupination and pronation. In all other animals, no claviculæ are to be found; and therefore the ſcapula is the principal, or rather, the only piece of which the ſhoulder is formed.

790. The motions and different ſituations of the ſhoulder in men depend chiefly on the ſcapula. The clavicle is puſhed or pulled in different directions by the other bone, and

entirely follows its motions, ſerving in ſome circumſtances to regulate or limit them.

791. It is neceſſary to examine with attention all the motions of which the ſcapula can be capable. It is not enough to ſay that it may be raiſed, brought down, forward, backward, *&c.* which language, as commonly underſtood, has given riſe to ſeveral falſe ideas concerning the action of the muſcles to which the motions of this bone are attributed.

792. When we raiſe the ſhoulder, this motion is not ordinarily made by an uniform elevation of the ſcapula, or, as it were, in a direction parallel to itſelf. It is the acromium which riſes, and while the ſuperior angle deſcends, the inferior angle is removed to a greater diſtance from the ſpina dorſi. When the ſhoulder is depreſſed, the acromium falls down more or leſs, the ſuperior angle riſes in proportion, and the inferior angle is brought nearer the vertebræ.

793. The ſhoulder can ſcarcely be brought forward or toward the foreſide of the thorax, without being proportionably raiſed; and there is the ſame difficulty in drawing it back without depreſſing it more or leſs. Every one may ſoon ſatisfy himſelf as to the truth of theſe facts. All theſe different attitudes are regulated by the clavicula, the angle which it naturally makes with the ſcapula, being leſſened or made more acute in raiſing the ſhoulder, or in bringing it forward; and increaſed or made more obtuſe when the ſhoulder is depreſſed, or drawn backward.

794. Therefore in moſt of the motions or changes of ſituation performed by the ſcapula, this bone turns more or leſs upon its own plane, and that in two contrary directions. It cannot indeed be abſolutely denied but that the ſcapula may be brought directly forward or backward, without being raiſed or depreſſed; but theſe are very conſtrained and very inconſiderable motions. In the firſt caſe, the acromium, together with the humeral extremity of the clavicula, is removed to a greater diſtance from the ribs, and in the ſecond, it is brought nearer to the ribs.

795. We ought to conſider, with particular attention, the ſituation and motion of the ſhoulder when we raiſe it to ſupport a burden, or apply it to any other reſiſtance. It is the acromium alone which is expoſed, and loaded, and with which we endeavour to overcome the reſiſtance or ſupport the bur-

den without ſinking under it. There muſt be muſcles proper for making all theſe efforts, and capable of producing all the different motions.

796. The three different portions of the trapezius, may all have the ſame uſe, according to what I have obſerved concerning the different turns of the ſcapula in its motions. This uſe is to raiſe the ſhoulder, and to keep it from ſinking. The upper portion draws the acromium and extremity of the clavicula upward. The inferior portion draws downward the ſmall extremity of the ſpine of the ſcapula. By theſe two coutrary motions, the ſituation of the ſpine is changed; and as the acromium, by reaſon of its articulations with the clavicle, cannot move backward while it riſes, the ſmall extremity of the ſpine muſt be removed to a greater diſtance from the vertebræ while it deſcends.

Trapezius.

797. The middle portion, by its ſuperior and longeſt fibres concurs with the action of the upper portion, more or leſs, according to the extent and direction of theſe fibres. The other fibres, which become gradually ſhorter and more tranſverſe, partly join in the ſame action by reaſon of the obliquity of the ſpine in which they are inſerted, and partly ſerve to regulate and limit the removal of the ſpine from the vertebræ already mentioned.

798. The upper fibres of this middle portion may likewiſe in ſome circumſtances ſupply the place of the ſuperior portion; as when we would raiſe the ſhoulder, the head being inclined to the ſame ſide; for then the fibres of the ſuperior portion which are inſerted in the Os Occipitis, have not room enough to contract. The obliquity of the upper fibres of the middle portion, and of the ſpine of the ſcapula, in which they are inſerted, facilitates their action in this caſe.

799. The uſe of the trapezius therefore, regard being had to the direction and inſertion of its fibres, is to raiſe the ſhoulder, or rather to turn the top of the ſcapula upward, and to hinder it from ſinking. But it is too thin, and conſiſts of too few fibres, to be able to overcome or bear up againſt ſome reſiſtances, without the co-operation of the ſerratus major, as we ſhall ſee preſently.

800. From this account of the uſe of the trapezius, we ſee how improper it is to ſay, with the generality of anatomiſts,

tomiſts, that the ſuperior portion of this muſcle draws the ſcapula obliquely upward; the inferior portion obliquely downward; and all the three portions directly backward. This way of ſpeaking is not only improper, but likewiſe leads us to imagine that by the action of the trapezius all the parts of the ſcapula are raiſed, depreſſed, or carried backward.

Serratus major.

801. The ſerratus major raiſes the ſhoulder or top of the ſcapula, brings it forward, and hinders it from ſinking. In all theſe it is the principal actor; and it is impoſſible to conceive how labourers raiſe and ſupport, by the ſhoulder alone, the heavy burdens with which they are loaded, without the aſſiſtance of this muſcle.

802. The thickneſs, length, and particular diſpoſition of its fibres, but above all, the inſertion of the greateſt portion of them, near the angle of the baſis ſcapulæ, prove ſufficiently what I advance; and the general action of the radiated portions is to draw the inferior angle from the ſpina dorſi, toward the lateral parts of the thorax.

803. The uppermoſt and ſtrongeſt portions pull this angle upwards at the ſame time, and conſequently raiſe the acromium, which cannot be puſhed forward, by reaſon of its connection with the clavicula.

804. Theſe ſuperior portions croſs over the greateſt part of the true ribs, and accordingly, in raiſing great burdens, we find ourſelves obliged to hold in our breath, that is, to leſſen expiration as much as we can, in order to fix the ribs, and to hinder them from ſinking, that they may ſerve for a ſolid fulcrum to this muſcle in proportion to the force with which it acts.

805. The next portions run according to the length of the ribs, and conſequently do not much conſtrain them in their reciprocal motions, not being in a condition either to raiſe or depreſs them; and the moſt inferior and weakeſt portions are only aſſiſtants to the reſt in bringing the lower angle of the ſcapula forward, toward the lateral part of the thorax.

806. The ſmall diſtinct plane deſcribed N° 164. is not an aſſiſtant to the radiated portions or inferior part of the great plane. It ſeems deſigned to regulate the motion of the ſuperior angle backward and downward, while the inferior is carried forward and upward by the radiated portions; and when

their action ceaſes, to bring the ſcapula back to its natural place.

807. The ſuperior portion of the great plane is an aſſiſtant partly to the radiated portion, and partly to the ſmall plane, according to the different places of its inſertions in the baſis of the ſcapula.

808. From all this we ſee that the principal uſe of the ſerratus major is to raiſe the ſhoulder, and not for reſpiration. When both planes act together, this muſcle may in ſome caſes bring the ſhoulder directly forward, or rather hinder it from going back; as when we puſh any thing with great force directly forward, with the hand, eſpecially when the arm is extended.

809. A whole treatiſe might be written on the numerous phænomena obſervable in the motion of the ſhoulder by the action of this muſcle; as I have ſhewn in the memoirs of the royal academy of ſciences. Some of theſe ſhall be mentioned in deſcribing the uſes of the other muſcles that move the ſhoulder; and when I come to thoſe which are employed in reſpiration, I ſhall explain more at length, why this muſcle can have no part therein.

Rhomboides. 810. According to the inſertions and direction of the rhomboides, its general uſe muſt be to draw backward and upward the ſub-ſpinal portion of the baſis ſcapulæ.

811. It is likewiſe a moderator to the trapezius and ſerratus major, when they raiſe the ſhoulder or carry the acromium upward; and it brings the ſcapula back to its natural ſituation, when the action of theſe muſcles ceaſes.

812. It may draw the ſcapula directly backward, if the inferior portion of the trapezius acts at the ſame time. For as this portion draws obliquely downward and toward the ſpina dorſi, and the rhomboides obliquely upward and toward the ſame ſpine; the joint action of both muſt produce a motion directly backward, as it happens when we pull back both ſhoulders equally, in order to diſengage them.

813. It may likewiſe, together with the radiated portion of the ſerratus major, draw the baſis of the ſcapula directly backward. This however is but an inconſiderable motion, and not ſo eaſy as the reſt; for the ſerratus major contributes to it only in proportion to the action of the rhomboides,

which is but very ſmall, and in this caſe the acromium can riſe but a very little way.

814. The angularis, by its inſertion in the ſuperior angle of the ſcapula, moderates the deſcent of that angle, while the trapezius and ſerratus major raiſe the acromium. Afterwards when theſe two muſcles ceaſe to act, the angularis raiſes the ſuperior angle, and by that means depreſſes the acromium, much in the ſame manner as was obſerved of the rhomboides.

Angularis.

815. From hence we ſee that this muſcle is very improperly called *levator ſcupulæ proprius*, ſince it does not raiſe, but depreſſes the ſcapula. That name would agree better to the ſerratus major. Whether this muſcle can have any ſhare in moving the neck, the ſcapula in which it is inſerted being kept immoveable by other muſcles, I cannot at preſent determine.

816. The pectoralis minor aſſiſts the rhomboides and angularis as moderators of the action of the trapezius and ſerratus major, in turning the point of the acromium upward, the ſuperior angle downward, and the inferior angle forward.

Pectoralis minor.

817. It is likewiſe an aſſiſtant to the rhomboides and angularis, in reſtoring the ſcapula to its natural ſituation, when the trapezius and ſerratus major ceaſe to act, by drawing downward the apophyſis coracoides in which it is inſerted.

818. It has been reckoned among the muſcles employed in reſpiration, by ſome who imagine that in ſome caſes the ſhoulder may be kept ſo ſteady, as that this muſcle may be able to raiſe the ribs in which it is fixed. But as the ſerratus major, which muſt principally be employed in keeping the ſhoulder in a fixed poſition, is partly inſerted in the ſame ribs, and in this action muſt keep them depreſſed, it will be impoſſible for the pectoralis minor to raiſe them.

819. The ſubclavius can have no other ordinary uſe, but to bring down the clavicula, after it has been raiſed together with the acromium by the action of the trapezius and ſerratus major. It may likewiſe hinder not only the clavicula in which it is inſerted, but likewiſe the acromium from riſing, eſpecially when aſſiſted by the pectoralis minor, rhomboides, and angularis.

Subclavius.

820. When we ſtand or ſit, the weight of the arm alone

ſeems to be ſufficient to bring down the clavicula when raiſed; and therefore, in this caſe, there would be no occaſion for the ſubclavius to act upon the clavicle, nor for the pectoralis minor, rhomboides, and angularis to act upon the acromium. But when we lie or are ſituated in any other manner, the weight of the arm has no ſuch effect; and in theſe caſes theſe four muſcles become more or leſs neceſſary.

821. The ſubclavius therefore is a proper depreſſor of the clavicula; and an aſſiſtant depreſſor of the acromium, or of the ſhoulder in general, together with the pectoralis minor, rhomboides, and angularis, all which, in their turns, aſſiſt the ſubclavius in its action on the clavicula.

822. I cannot conceive what has led ſeveral great anatomiſts to rank this among the muſcles of reſpiration; ſince it is inſerted, not only in the bone, but in the cartilage of the firſt rib; ſince this cartilage is not articulated with the ſternum, but joined to it as immoveably as to the bone of the rib by its other extremity; and laſtly, ſince this cartilage is much ſhorter, much broader, and much leſs pliable than the cartilages of all the other ribs, of equal thickneſs.

§ 2. *Uſes of the muſcles which move the Os Humeri on the ſcapula.*

823. This muſcle, from the diſpoſition of its inſertions in the ſcapula and clavicle, may raiſe the arm, or ſeparate it from the ribs, not only directly, but likewiſe obliquely in many different ways. The arm being lifted directly upward, the lateral, anterior, and poſterior portions of this muſcle, may bring the arm ſo raiſed, forward and backward. In that caſe, the middle portion of the muſcle is the principal mover, and the lateral portions are the directors or collateral muſcles.

Deltoides.

824. When we ſtand or ſit, this muſcle alone, without the help of any other, regulates the depreſſion of the arm, by means only of the weight of the part. This depreſſion is brought about merely by the relaxation of this muſcle, proportionable to the degree of velocity it has required according as the will directs.

825. But when we lie, other muſcles are neceſſary to bring the arm near the ribs, when the deltoides has carried it to

any diſtance from them. Yet even in this caſe, when the arm is laid cloſe to the ribs, the lateral portions of the deltoides may preſs it harder againſt them, by reaſon of the change of direction of the fibres in this ſituation.

826. By reaſon of the multiplicity of fleſhy fibres, this muſcle muſt act with a very conſiderable force.

Latiſſimus Dorſi.

827. The latiſſimus dorſi ſerves in general to bring down the arm when raiſed; and this it does chiefly by its inferior portion. By the ſame portion, and by the connection of the ſcapula with the Os Humeri, it ſerves to depreſs the ſhoulder, or to maintain it in that ſituation againſt any force that endeavours to raiſe it; as when we lean upon the elbow in ſitting, or walk upon crutches.

828. By its dorſal inſertion, by the paſſage of its tendon on the inſide of the Os Humeri, and by its inſertion in the foreſide of that bone, it may turn the arm round its axis, called *rotation* by anatomiſts; as it happens when having bent the fore-arm, we turn it behind our back.

829. By its inſertion in the criſta of the Os Ilium, and in the falſe ribs, it becomes neceſſary to raiſe the head laterally to one ſide, when we lie on the other. For the ſhoulder being then depreſſed and brought near the thorax, the clavicle becomes the fixed point of one or two of the muſcles which raiſe the head in this ſituation, as ſhall be ſhewn more at length in ſpeaking of the uſes of theſe muſcles. Any perſon may make the experiment in bed, by lying at full length on his ſide: for if, while he raiſes his head in this poſture, he lay his hand on the anterior edge of this muſcle, he will find it conſiderably ſtretched, and alſo, that this tenſion ceaſes whenever he ceaſes to lift his head.

830. The connection of this muſcle with the falſe ribs, is the cauſe of that uneaſineſs which we find in breathing, when the arm is pulled ſtrongly downward to preſs upon any thing, as when we ſeal a letter, or lean upon a ſhort cane, the fore-arm being extended.

831. The ſmall portion inſerted in the inferior angle of the ſcapula, may be an aſſiſtant to the teres major, as ſhall be ſhewn hereafter.

832. This muſcle ſuſtains the weight of the whole body, when with the arms raiſed, we hang by the hands, as when we graſp the branch of a tree in climbing.

833. It performs the ſame office, when we either ſit or ſtand, with the whole arm more or leſs extended horizontally, and preſs the hand from above downward againſt any reſiſtance; as when we ſupport ourſelves in this ſituation, by a very long cane graſped by the hand; or lay hold of the upper part of an halbard, and preſs the lower end ſtrongly againſt the ground

834. Theſe laſt three uſes cannot however be well executed by this muſcle alone, without the aſſiſtance of the pectoralis major.

Pectoralis major.

835. The pectoralis major ſerves in general, to bring the arm near the ribs, to preſs it ſtrongly againſt them, and to carry it towards the forepart of the thorax. This laſt motion may be performed without ſeparating the arm from the ribs, as when one arm is croſſed over the other; and it may likewiſe be done with the arm raiſed, as when the hand of one ſide is laid over the ſhoulder of the other ſide; and in that caſe the anterior portion of the deltoides may aſſiſt this muſcle in great efforts.

836. By means of the fold in its tendon, the ſuperior and inferior portions may act as two diſtinct muſcles, that is, one may act without the other. The ſuperior fleſhy portion which anſwers to the lower portion of the tendon, ſerves chiefly to raiſe the arm forward.

837. The inferior fleſhy portion which is joined to the upper portion of the tendon, by its inſertion in the Os Humeri, and by the connection of that bone with the ſcapula, may depreſs the ſhoulder or keep it from riſing, with more or leſs force, much after the ſame manner as the inferior portion of the latiſſimus dorſi; the inferior portions of theſe two muſcles concurring in the ſame uſe; as when we ſupport ourſelves upon our hands or walk with crutches, as has been already ſaid.

838. It is likewiſe by means of the lower portion of this muſcle, that we can ſuſpend the whole body by the hands graſping the branch of a tree in climbing, *&c.* In this caſe alſo, the latiſſimus dorſi acts in concert with the pectoralis; and this co-operation, the painters and carvers have taken care to expreſs in crucifixes.

839. The inferior portion of this muſcle cannot perform theſe two uſes without the aſſiſtance of the muſcles of the

abdomen, which, by pulling the ribs downward, become in a manner a continuation of the inſertion of this portion. The ſame thing may be obſerved concerning that part of the inferior portion of the latiſſimus dorſi, which is inſerted in the falſe ribs.

840. The uſes of the ſuperior portion and of all the body of the pectoralis, cannot take place without the co-operation of the muſcles which move the ſcapula on the trunk, eſpecially the ſerratus major; becauſe the ſcapula muſt be ſecurely fixed, before it can be a fulcrum for the Os Humeri to move upon. The ſame thing is to be obſerved concerning the deltoides, and all the other muſcles which move the Os Humeri on the ſcapula.

Teres Major.

841. The teres major, by being inſerted in the Os Humeri in a direction parallel to the latiſſimus dorſi, becomes a congener to the ſuperior and poſterior portion of that muſcle; and accordingly moves the Os Humeri in the ſame manner with it. It turns the bone round its axis, when the fore-arm is carried behind the back.

842. It likewiſe pulls the arm directly backward without moving it round its axis. But neither this muſcle nor the latiſſimus dorſi can perform this ſimple motion, becauſe of the incurvated direction of their tendons, without the aſſiſtance of other muſcles, which, like antagoniſts, prevent the rotation already mentioned; and of this number is the teres minor, as we ſhall ſee preſently.

843. The nearneſs of the tendon of this muſcle to that of the latiſſimus dorſi deſerves our attention. They are both inſerted, according to their breadth, in the ſame line, along the edge of the bony channel of the Os Humeri, oppoſite to the inſertion of the pectoralis major in the other edge of the ſame channel. Theſe two tendons croſs each other in the ſame plane, that of the teres major running obliquely from above downward, and that of the latiſſimus dorſi, obliquely from below upward.

844. By this diſpoſition, theſe two tendons reſemble, in a great meaſure, the duplicature or fold of the tendon of the pectoralis major; and therefore the teres major may become a particular antagoniſt to the ſuperior portion of the pectoralis major; and the latiſſimus dorſi to the inferior portion;

and both muſcles taken together may be a common antagoniſt to the pectoralis major, when that whole muſcle acts at the ſame time.

845. I obſerved, N° 198. 204. that theſe two tendons were bound down by a ligamentary frænum, which from the inſertion of the ſubſcapularis runs down below that of the teres major; and that this frænum covers the two tendons, and braces them down cloſe to the bone. The uſe of this frænum ſeems to be to prevent the ſeparation of the two tendons from the edge of the groove in violent rotations of the arm.

846. The teres major may likewiſe move the ſcapula on the Os Humeri, by drawing the inferior angle downward, and bringing it nearer the arm; but, in order to this, the arm muſt be kept immoveable by ſome conſiderable force or reſiſtance; as when in ſtanding with the whole arm hanging down, the hand ſupports a great weight. By this action the teres major may likewiſe aſſiſt in raiſing the ſhoulder, or in hindering it from ſinking.

Coraco-brachialis.

847. The coraco brachialis brings the arm to the foreſide of the thorax, raiſing it at the ſame time; and in this caſe it may be reckoned a congener or aſſiſtant to the pectoralis major in great efforts; and may perform the ſame motion by itſelf, when no great force is neceſſary; as when the whole arm hangs down, and is moved backward and forward like a pendulum, the motion forward being performed by the coraco-brachialis, and the motion backward by the teres major its antagoniſt.

848. This muſcle may likewiſe move the ſcapula on the Os Humeri, kept firmly depreſſed, as when ſitting in a chair we take faſt hold of the edge of it with the hand. In this caſe the coraco-brachialis may bring the acromium downward, and the inferior angle of the ſcapula, near the vertebræ. It ſerves likewiſe to bring the arm to its former ſituation, after it has been turned by the latiſſimus dorſi, in order to apply the hand to the back; and then it turns the Os Humeri upon its axis in a contrary direction to that given it by the other muſcle.

Supra-ſpinatus.

849. The ſupra-ſpinatus is commonly ſuppoſed to join with the deltoides in lifting up the arm; this muſcle beginning that action, and the deltoides

continuing it. But beſides that this muſcle is very ſmall, it ſeems to be too near the articulation of the head of the Os Humeri, to be able to raiſe the whole upper extremity, which is of a conſiderable weight and length. It has however two other very remarkable uſes, when the arm is raiſed from the thorax to the head by the action of the deltoides.

850. To underſtand theſe uſes, it muſt be remembered, (1.) That the cartilaginous convex part of the head of the Os Humeri is much larger than the glenoide cavity of the ſcapula. (2.) That the moſt ſuperior part of this convexity lies out of the cavity when the arm is depreſſed or near the ribs. (3.) That the orbicular ligament of the joint is very broad, being proportioned to the diſtance between the edges of the convex part of the head of the Os Humeri, and of the glenoide cavity of the ſcapula and that therefore it cannot check the Os Humeri in any of its motions.

851. From thence it is plain, that the ſtrong deltoide muſcle in the firſt inſtant of its action to raiſe the arm, would thruſt the head of the Os Humeri upwards out of the cavity; if ſomething did not ſupply the place either of a bony fulcrum or ligamentary frænum. The arch of the acromium is of no uſe in this caſe; for the bone muſt be firſt luxated, before it can reach ſo far, and the neighbouring parts muſt ſuffer a friction, and even a contuſion, which would be very prejudicial.

852. It is likewiſe plain that the broad orbicular ligament would be very apt to be entangled and bruiſed between the edges of the two articulated bones, were not this inconveniency prevented by ſome means or other; becauſe it is not elaſtic enough to contract of itſelf in proportion as theſe two edges approach each other.

853. The ſupra-ſpinatus anſwers both theſe ends. When it contracts its tendon, which runs over the convex part of the head of the Os Humeri, to be inſerted in the upper ſurface of the great tuberoſity, it preſſes very ſtrongly on the head of the bone, thereby ſupplying the place of a fulcrum, and hindering the head to riſe, during the beginning of the action of the deltoides; and in this action, it is aſſiſted by the ligamentary annular rope mentioned in the deſcription of the freſh bones, No 250.

854. I find likewiſe in this muſcle a ſingular contrivance to prevent the ſecond inconveniency. Its tendon is a kind of band, which adheres cloſely to the outſide of the orbicular ligament; and when we examine it narrowly, we obſerve that ſeveral of its fibres do not go ſo far as the head of the Os Humeri, but are gradually inſerted in the outer ſurface of the ligament. Theſe tendinous fibres are continuous with thoſe which lie neareſt the bone or bottom of the ſupra-ſpinal cavity of the ſcapula.

855. This portion may therefore be reckoned a diſtinct muſcle belonging to the orbicular ligament, notwithſtanding of its cloſe union with the other portion, which is inſerted in the Os Humeri. And indeed we might very juſtly eſtabliſh a new ſpecies of muſcles by the name of *articular muſcles*, which belong chiefly to the capſular ligaments of thoſe joints which have large degrees of motion; ſeveral examples of which we ſhall meet with hereafter.

856. The mechaniſm of this kind of muſcles conſiſts in this. The extremities of the tendons are inſerted very obliquely in the ſurface of the ligament, and the fibres take up a great deal more ſpace there, than in the body of the tendon; and they are commonly the innermoſt, or deepeſt and ſhorteſt portions of the ordinary muſcles inſerted near the articulations.

857. The uſe of theſe muſcles, or portions of muſcles, is to pull the orbicular ligaments uniformly, and thereby to prevent their running into irregular folds, and their being intangled between the two articulated bones.

Infra-ſpinatus.

858. The infra-ſpinatus being inſerted by its tendon in the middle ſurface of the great tuberoſity of the Os Humeri, muſt perform different motions according to the different ſituations of that bone. If it acts while the arm hangs down, parallel to the trunk of the body, it may move the Os Humeri round its axis from before outward, and conſequently, if the fore-arm be at the ſame time bent, it will turn the hand from the body.

859. If while the arm is kept raiſed by the deltoides, the poſterior portion of that muſcle draws the arm backward; the infra-ſpinatus has the ſame uſe with reſpect to the orbicular ligament, as the ſupra-ſpinatus already deſcribed. And as theſe two muſcles adhere cloſely by the edges of their

tendons, they may in ſome meaſure co-operate in their action, on that ligament.

860. When the arm, raiſed in the manner already ſaid, is ſtrongly pulled forward by the pectoralis major, a conſiderable force is neceſſary to prevent the head of the Os Humeri from being thrown backward out of the glenoide cavity. The ſtructure of the infra-ſpinatus and the number of its fibres, which is much greater than in the ſupra ſpinatus, fit it for anſwering this purpoſe; in which it is likewiſe aſſiſted by the flat, broad, thin ligament mentioned in the deſcription of the freſh bones, N° 250. This muſcle may likewiſe aſſiſt the teres major in great efforts.

Subſcapularis.

861. The uſe commonly aſcribed to the ſubſcapularis, of preſſing the arm againſt the ribs, from which it has the name of *porte feuille* in French, is without foundation. When the arm hangs down in its natural ſituation, this muſcle may turn it round its axis, from without forward, as it happens when in this ſituation, we beat the breaſt with the fore-arm bent; and it likewiſe ſtrongly aſſiſts the latiſſimus dorſi, when we turn the hand behind the back.

862. When the arm being raiſed, we move it backward, as in giving a back-ſtroke with the elbow or fiſt; the ſubſcapularis hinders the head of the Os Humeri from being luxated forward; for which purpoſe it is well fitted both by its ſtructure and number of its fibres, this motion being ſometimes performed with great violence.

863. It may likewiſe, by means of the nearneſs and lateral union of its tendon with that of the ſupra-ſpinatus, aſſiſt that muſcle in keeping the head of the Os Humeri in the glenoide cavity, when the other extremity of the bone is raiſed.

Teres minor.

864. The teres minor may turn the arm when depreſſed round its axis, from before outward; as it happens when the form-arm being bent and applied to the lower part of the breaſt, is removed from thence, without moving the elbow from the ſide. This rotation is in a contrary direction to that performed by the ſubſcapularis and teres major.

865. This muſcle may likewiſe pull the arm directly backward, whether raiſed or depreſſed; but in order to this, the

ſubſcapularis muſt act at the ſame time as a moderator to prevent the rotation. The co-operation of muſcles is neceſſary in all particular motions, but in ſome more than in others.

§ 3. *Uſes of the muſcles which move the fore-arm on the Os Humeri.*

866. The biceps which I likewiſe name *coraco-radialis*, becauſe one of its two ſuperior inſertions is in the coracoide apophyſis, the other near the baſis of that apophyſis, moves the fore-arm in two different manners; that is, it bends both bones, and turns the radius upon the ulna; performing both motions by its inſertion in the radius alone. It likewiſe moves the Os Humeri on the fore-arm, the ſcapula on the Os Humeri, and the Os Humeri on the ſcapula. *Biceps.*

867. Theſe five uſes belong to this muſcle, though it is commonly limited to that of bending the fore-arm; and to theſe we may add a ſixth, by means of the paſſage of one of its ſuperior tendons over the articulation of the Os Humeri with the ſcapula, through a ligamentary vagina which ſerves as a frænum, and may be looked upon as an annular ligament produced.

868. When it bends the fore-arm upon the Os Humeri, the ſcapula muſt be kept ſteady by the muſcles which move it on the trunk; and in this function it is a congener or aſſiſtant to the brachialis, which is inſerted in the ulna; and when the brachialis becomes incapable of acting by a wound or any other diſeaſe, the biceps alone may perform the flexion of the fore-arm, by being inſerted in the radius, and by the connection of that bone with the ulna.

869. To be ſatisfied that it turns the radius, and performs the motion called *ſupination*, we need only conſider the manner of its inſertion in the tuberoſity of the radius, already deſcribed, and then look on a ſkeleton: and even without theſe aſſiſtances the following experiment will prove this uſe.

870. If when the fore-arm is moderately bent, and in a pronated ſituation, we perform the motion of ſupination with the hand, and lay the other hand on the biceps at the ſame time, we will perceive it to ſwell and grow hard in proportion

tion as the ſupination advances. This muſcle is therefore a true ſupinator.

871. The third uſe of the biceps which is to move the Os Humeri on the fore-arm, cannot have place till the fore-arm is fixed by ſome exterior force, as when we hold the branch of a tree with the hands, the arm being extended, and afterwards bend the arm in order to climb. In this caſe, part of the flexion is performed by the motion of the Os Humeri on the fore arm. And though this whole action is not owing to the biceps, yet it as really contributes to it, as the brachialis.

872. The fourth uſe of the biceps is to move the ſcapula on the Os Humeri. In order to this, the whole arm muſt be kept fixed much in the ſame manner as was mentioned in deſcribing a like uſe of the coraco-brachialis; whether this be done by any exterior reſiſtance applied to the fore-arm or hand; or by preſſing the two hands ſtrongly againſt each other behind the lower part of the back. In theſe caſes, the contraction of theſe muſcles will draw down the acromia, and bring the baſes of the ſcapulæ nearer each other.

873. The fifth uſe of this muſcle is to move the Os Humeri on the ſcapula, by raiſing it much in the ſame manner as is done by the coraco-brachialis. The manner how this is performed, is eaſily conceived; as alſo that it is done moſt readily when the fore-arm is extended.

874. The particular uſe of the tendon which paſſes through the ligamentary vagina, over the articulation of the ſcapula with the Os Humeri, is to co-operate with the tendon of the ſupra-ſpinatus in hindering the head of the Os Humeri from getting out of the glenoide cavity, in the firſt efforts of the deltoides to raiſe the arm.

875. Though this tendon of the biceps be very ſmall, and though it paſſes over a very ſmooth poliſhed convex ſurface; yet it cannot ſlip to either ſide, becauſe of the thick vagina which lies between the two tuberoſities of the head of the Os Humeri, and there chiefly confines it. Beſides, in proportion as the arm is raiſed, that part of rhe tendon which paſſes over the joint, becomes gradually ſhorter, becauſe the frænum approaches, by the ſame degrees, to the place where it is inſerted.

Brachialis. 876. The brachialis ſerves to bend the fore-arm on the Os Humeri, by its inſertion in the ulna, and by the connection of that bone with the radius. It ſerves alſo to move the Os Humeri on the fore-arm.

877. The ſmall lateral portions of the lower extremity of the fleſhy body of this muſcle. and the fleſhy fibres between theſe portions, neareſt the bone, are very ſhort, and ſeem to make a diſtinct muſcle, which does not reach to the ulna, but is inſerted in the capſular ligament of the joint of the elbow.

878. Theſe inſertions in the ligament are very apparent in many ſubjects, and their uſe ſeems to be much the ſame with what I aſcribed to the like fibres in the ſupra-ſpinatus, that is, to prevent the ligament from being catched and ſqueezed between the bones, in great flexions of the arm.

Anconæus maximus. 879. The anconæus maximus ſerves to extend the fore-arm, by bringing the ulna to a ſtraight line with the Os Humeri. It ſerves likewiſe to extend the Os Humeri on the ulna, when the laſt named bone is fixed by ſome exterior reſiſtance, as when being laid upon the ground, we riſe by ſupporting ourſelves on our hand. In this caſe likewiſe, the ſcapula muſt be kept ſteady by the coraco-brachialis.

880 It may likewiſe move the ſcapula on the Os Humeri by its inſertion in the neck of the firſt of theſe bones, by means of which it may draw the baſis downward and raiſe the top of the ſhoulder.

881. By its inſertion in the ſcapula, it may likewiſe draw the arm backward in a more direct line than can be done by the teres major and minor.

Anconæi laterales. 882. The two lateral anconæi co-operate with and aſſiſt the anconæus maximus in extending the fore-arm on the Os Humeri, and the Os Humeri on the fore-arm.

Anconæus minimus. 883. The anconæus minimus may concur with the other muſcles of that name, in extending the fore-arm on the Os Humeri, and the Os Humeri on the fore-arm; but its action does not reach to all the degrees of flexion of theſe bones; for when the fore-arm is very much bent, if we examine carefully the ſituation of this muſcle, we will find it more diſpoſed to maintain theſe bones in that poſture, by co-operating with the brachialis, than to extend them by aſſiſting the other anconæi.

§ 4. *The uſes of the muſcles which move the radius on the ulna.*

884. The ſupinator longus was believed to be concerned only in the motion of ſupination, till M. Heiſter very juſtly obſerved that it was likewiſe a flexor of the fore arm. And indeed a very ſmall degree of attention to its inſertion and ſituation, muſt convince us that it is much better fitted for this laſt uſe than for the firſt. For before it can act as a ſupinator, the hand muſt be in the greateſt degree of pronation; annd even then it can do little more than bring the radius back to its natural ſituation, without completing the ſupination except it be by jerks. It would therefore be much more properly named *radialis longus*, than *ſupinator longus*.

Supinator longus.

885. This muſcle may bend the fore-arm by means of the connection of the radius with the ulna in ſeveral different ſituations, that is, when the fore-arm is fully extended, the radius being either in a motion of pronation or ſupination, or in a middle ſituation between both.

886. On this occaſion it is proper to obſerve, that the method of examining the uſes of the muſcles on dead bodies, by pulling them in order to move the bones in which they are inſerted, is very uncertain, except particular care be taken to pull them in their true natural direction, which is often different from what it appears to be when they are diſſected, by reaſon of the lateral connections, fræna, &c.

887. Supination performed when the fore-arm is fully extended, is commonly attributed in part to the rotation of the Os Humeri, by means of its articulation with the ſcapula, as if this ſupination when the fore-arm is extended were greater than when it is bent; whereas the difference in ſupination is really but very ſmall, though it be very conſiderable in the motions of pronation, as we ſhall ſee hereafter.

888. The ſupinator brevis ſeems to have no other uſe than what is expreſſed by its name; and as it is a ſhort ſmall muſcle, it muſt be very weak. Its uſe is chiefly owing to the obliquity of its fibres; but ſtill

Supinator brevis.

neither this nor the former muſcle would be able to perform ſupination, where a great force is required, without the aſſiſtance of the biceps, which is the moſt powerful of all the ſupinators, and the chief actor in this motion, as I have already proved.

Pronator teres.

889. The pronator teres can have no other action but that of pronation, in the different ſituations of the radius, whether that bone be in a middle ſtate between pronation and ſupination, or in the greateſt degree of ſupination; and in this caſe, though it is but a ſmall weak muſcle, it overcomes the ſupinator longus.

Pronator quadratus.

890. The pronator quadratus is capable of no other motion but pronation, and it acts with much more force than its congener the pronator teres; both becauſe of the number and direction of its fibres, and becauſe it acts upon the radius near the lower extremity, where its effects in pronation are much greater than if it acted near the head of that bone. The fibres lie almoſt in the ſame direction in which the bone moves; and in this it has the advantage not only over the other pronator, but over all the ſupinators, the biceps itſelf not excepted.

891. The fibres of which this muſcle is compoſed are ſo diſpoſed as that the longeſt adhere to the internal angles of both bones of the fore-arm; the ſhorteſt lie neareſt the interoſſeous ligament, and the intermediate fibres are longer or ſhorter according to their greater or leſs diſtance from the ligament.

892. By theſe different degrees of length, the whole number of fibres is advantageouſly diſpoſed, and their action rendered uniform. In the greateſt degree of ſupination, the extremity of theſe fibres inſerted in the two bones makes a very oblique plane, which becomes almoſt ſtraight in the greateſt degree of pronation. We ſhall have other examples of this kind of mechaniſm hereafter, and it ſhall then be explained and accounted for.

Remarks on the motions of pronation and ſupination.

893. The motions of pronation and ſupination are commonly attributed to the radius alone; and the ulna is believed to have no other ſhare therein, than to ſerve as a fulcrum or baſis on which theſe reciprocal turns or rotations of the radius are

made; and laſtly, theſe motions are ſaid to be the effects of four muſcles, or at moſt of five, the biceps being included.

894. Anatomiſts likewiſe pretend that they have ſeen others demonſtrate; that they have demonſtrated themſelves; and that they are able at any time to demonſtrate, both on the ſkeleton and on freſh ſubjects, theſe two reciprocal motions, without any motion in the ulna; and they have even gone ſo far, both in public and private, as to make experiments on their own arms, to prove that the radius alone performs theſe motions, and that the ulna has no ſhare in them.

895. All this notwithſtanding, I have obſerved and demonſtrated to the royal academy of ſciences, that in theſe motions, when free and unconſtrained, the two bones of the fore-arm move always at the ſame time. Thus, for inſtance, when we turn the radius toward the breaſt in pronation, the ulna is at the ſame time turned from the breaſt; and when we turn the radius, from the breaſt in ſupination, the ulna is at the ſame time brought nearer it, ſuppoſing in both theſe motions that the fore-arm is bent.

896. In theſe motions the radius rolls ſimply from one ſide to the other; its extremity in a complete pronation or ſupination, deſcribing a kind of ſemicircle; and at the ſame time the extremity of the ulna moving in a contrary direction deſcribes another ſemicircle. Thus in proportion we raiſe the exremity of the ulna, and remove it from the breaſt at the ſame time; and in ſupination we firſt depreſs it, and then raiſe it again, as it is brought nearer the breaſt.

897. Neither is this all; for theſe ſmall motions of raiſing and lowering, of adduction and abduction in the extremity of the ulna, cannot be brought about without the rotation of the Os Humeri, becauſe of the ginglymus by which theſe two bones are articulated. Therefore in all unconſtrained pronations and ſupinations, three bones muſt move, and all the muſcles concerned in theſe motions muſt act; and likewiſe, during this action, the ſcapula muſt be kept fixed.

§ 5. *Uſes of the muſcles which move the carpus on the fore-arm.*

898. The motion of the carpus is made principally on

the extremity of the radius; and on the ulna, only by the intervention of the interarticular cartilage or cartilaginous production of the radius. We are not to have regard only to the carpus in general in theſe motions, becauſe ſome of them relate alſo to the metacarpus, and others to particular bones of the carpus. The motions of the carpus affect likewiſe the whole hand, which is thereby carried different ways, and put in different ſituations.

899. The chief motions of the carpus are expreſſed by terms not altogether proper, but which may be retained, as having been long in uſe, provided they be well explained to thoſe who are not accuſtomed to them. Turning the hand toward the inſide of the two bones of the fore-arm, is called *bending the wriſt*; and the wriſt is ſaid to be extended when the hand is turned toward the outſide of the fore-arm. When it is turned toward the radius alone, that motion is termed *adduction* with regard to the Os Humeri; and *abduction* in the ſame ſenſe, is when the hand is turned toward the ulna alone.

900. Theſe motions are attributed to four muſcles; the ulnaris internus, radialis internus, ulnaris externus, and radialis externus, or bicornis. Flexion is performed by the two internal muſcles; extenſion by the two external; abduction by the two ulnares, and adduction by the two radiales.

901. Theſe muſcles may likewiſe ſucceſſively perform ſeveral ſubaltern or oblique motions of the carpus and hand, by the combination of two principal or direct motions. Thus, the radius being fixed in its natural ſituation between pronation and ſupination, we may, by a motion of flexion and abduction together, turn the hand obliquely, and at the ſame time partly towards the fold of the arm, and partly toward the external condyle.

902. Theſe combined motions cannot however be performed with near ſo much freedom as the ſimple motions of flexion, &c. becauſe of the oblong figure of the joint of the wriſt; and the eaſe and readineſs with which they ſeem to be performed, is owing to the aſſiſtance of the motions of ſupination and pronation.

Ulnaris internus. 903. When the ulnaris internus acts alone, or as the principal mover, it brings the hand obliquely toward the internal condyle, and toward the olecranum, though with difficulty, for the reaſon already given.

904. When it acts together with the radialis internus, it turns the hand equally towards the two extremities of the bones of the fore-arm; and thereby moves not only the carpus in general on the fore-arm, but alſo the ſecond row of the carpus on the firſt, and the metacarpal bones on the ſecond.

905. When it acts with the ulnaris externus, it turns the outer edge of the hand toward the olecranum.

Ulnaris externus.

906. When the ulnaris externus acts with the ulnaris internus, it turns the outer edge of the hand toward the olecranum, as already ſaid.

907. With the radialis externi, it turns the back of the hand toward the outer condyle. This motion is termed *extenſion*, but very improperly when applied to the hand; for the metacarpus which is naturally bent this way, will be ſtill more bent by the action of theſe muſcles. I ſhould chuſe therefore to term this motion the *inverſion* rather than the *extenſion of the hand.* The carpus indeed may in ſome ſenſe be ſaid to be extended, becauſe the bones of the ſecond row are brought to a ſtraighter line with thoſe of the firſt.

908. When this muſcle acts alone, it brings the outer edge of the hand obliquely toward the olecranum and the external condyle at the ſame time; but this is performed with difficulty, as has been already obſerved.

Radialis internus.

909. The radialis internus, together with the ulnaris internus, has the uſes already mentioned.

910. With the radialis externus, it carries the inner edge of the hand, or that next the thumb, towards the extremity of the radius, and toward the fold made by the ulna and Os Humeri.

911. Alone, it moves that part of the hand which is next the thumb obliquely, toward the internal angle of the radius, but with the ſame difficulty as the reſt, when they act ſingly.

912. It ſeems likewiſe to deſerve the name of a *third pronator.* What firſt gave me a notion of this uſe was the conſideration of the obliquity of its direction between its two inſertions, which is greater in proportion than that of the ſupinator longus, which therefore muſt be leſs fitted for ſupination, than the other is for pronation. I look upon the an-

nular ligament through which the tendon of the radialis internus paſſes, as a ſort of inſertion with reſpect to the direction of the muſcle, and we plainly perceive the tendon to be ſtretched in a ſtrong motion of pronation.

Radialis externus. 913. The radialis externus, together with the radialis internus, turns the inner edge of the hand directly toward the ſtyloide apophyſis of the radius.

914. With the ulnaris externus it inverts the hand, turning the convex ſide of the metacarpus toward the lower extremity of the bones of the fore-arm. It likewiſe moves the ſecond row of the carpus on the firſt, and thereby increaſes the tranſverſe fold on the convex ſide of the carpus, mentioned in the general obſervations on the ſituation of the bones of the upper extremity. This motion likewiſe increaſes the angle which the back of the hand naturally makes with the outſide of the fore-arm; and therefore, according to the common language, it would be more properly termed a flexion outward than on extenſion.

915. This muſcle acting alone draws obliquely, and toward the external angle of the radius, that portion of the hand which anſwers to the firſt metacarpal bone and to the index; but this is done with the ſame difficulty that has been already taken notice of in the other muſcles.

916. Each of the two radiales externi may act ſeparately, and conſequently have diſtinct uſes, ſince their tendons having paſſed the annular ligament, are inſerted at ſome diſtance from each other; and thereby one of them ſeems to be fitted to co-operate with the radialis internus, the other with the ulnaris externus; and they both ſerve conjointly to keep the hand in its true natural ſituation mentioned in the deſcription of the ſkeleton.

Ulnaris gracilis. 917. The ulnaris gracilis, commonly called *palmaris longus*, ſeems to be an aſſiſtant to the ulnaris and radialis interni in bending the wriſt; and it ſeems likewiſe particularly to aſſiſt the radialis internus in the motion of pronation.

Metacarpius. 918. The metacarpius ſerves to turn the fourth bone of the metacarpus toward the thumb, and at the ſame time to increaſe the convexity of the back of the hand, which is called *making Diogenes's cup*. The fourth bone thus moved carries the third along with it by reaſon of their connection, which ſtill augments the hollow on one ſide, and the convexity on the other.

§ 6. *Uſes of the muſcles which move the fingers.*

919. The perforatus ſerves to bend the ſecond phalanges of all the fingers except the thumb; and the particular muſcles of which it is made up, may act ſeparately, by reaſon of their diſtinct inſertions in theſe phalanges. The union of the fleſhy bodies by middle tendinous ſepta may have ſeveral uſes; the chief of which is, that theſe ſepta being very broad and thin, give inſertion to a great number of fleſhy fibres in a very ſmall compaſs, and thereby ſupply the place of four large tendons, which would have taken up much more room; but, by this union, theſe four muſcles are more diſpoſed to act jointly than ſeparately. *Perforatus.*

920. They not only bend the ſecond phalanges on the firſt, but alſo the firſt on the metacarpal bones, and the metacarpus and carpus on the fore-arm. To conceive the mechaniſm and force of theſe muſcles, which is very great and neceſſary in certain circumſtances, we muſt call to mind an obſervation already made concerning the muſcles of the ſcapula; that every muſcle which can move a bone in any given direction, is likewiſe able with the ſame force to keep it immoveable in any ſituation againſt whatever tends to move it in a contrary direction. The following examples will ſufficiently illuſtrate this obſervation.

921. It is by bending the fingers that we raiſe the greateſt weights, that ſailors pull large oars, that printers turn the ſcrews of their preſſes, and that climbers ſupport their whole bodies even with an additional burden upon them. It is by means of the fingers when bent, that we tear, pull up, bruiſe, *&c.* things that require a very great force to tear, pull up, or bruiſe them.

922. I obſerved in the beginning of this deſcription of the muſcles, N° 54. 55. that the ſtrength of muſcles depends on the multitude of their fleſhy fibres, and the extent of their motions, on the length of theſe fibres; and conſequently wherever ſtrength is more neceſſary than large degrees of motion, there we find the fibres of muſcles proportionably increaſed in number; and wherever there is more occaſion for

a large degree of motion than for ſtrength, the fleſhy fibres are of a proportionable length.

923. In the perforatus we meet with both theſe contrivances, a great number of fibres for ſtrength of motion, and a great length of fibres for extent of motion. The different tendinous ſepta ſerve to give inſertions to a number of moving fibres ſufficient for the ſtrength required in the caſes already mentioned.

924. Large degrees of motion are likewiſe ſometimes very neceſſary in this muſcle, as for inſtance, when we bend the fingers at the ſame time that the metacarpus and carpus are bent on the fore-arm; and in this caſe certain faſciculi of fibres are chiefly employed, which appear to be longer than the reſt.

925. The particular uſe of the tendons of this muſcle will be better underſtood with that of the perforans.

Perforans.

926. The perforans bends particulary the third phalanges in which it is inſerted; and by the ſame motion it may likewiſe bend the firſt and ſecond phalanges. We may apply to this muſcle all that has been ſaid concerning the tendinous ſepta in the perforatus, and concerning its action, which is ſometimes common to all the four ſubaltern muſcles, ſometimes peculiar to one or more of them.

927. It may likewiſe be eſteemed an aſſiſtant to the ulnaris and radialis interni in great efforts; and theſe muſcles may be reciprocally looked upon as aſſiſtants to the perforatus and perforans.

928. Each of theſe four tendons paſſes under a diſtinct annular ligament as under a pulley; for having accompanied that of the perforatus through the great ligament of the carpus, through the furcæ of the aponeuroſis palmaris, and through the ligamentary vaginæ of the firſt phalanx, and having paſſed through the ſlits of the perforatus, it leaves this tendon, and continues its courſe to the third phalanx through the ligamentary vagina of the ſecond.

929. In its paſſage through the ſlit of the perforatus, it is liable to no compreſſion even in the moſt violent efforts of that muſcle. The reciprocal contortions of the two flat portions of the fiſſure, and their crucial inſertion in the flat ſide of the third phalanx, hinder the little oblique grooves mentioned in the deſcription, from cloſing, and the two lateral

portions of the fiſſure from coming together, even after the tendon of the perforans has been removed. And the more this part of the tendon is pulled, the more perfectly does the fiſſure form a ſort of channel with ſolid ſides, and with the two ends cut obliquely. All this I demonſtrated in the royal academy on a freſh ſubject, and I imitated it artificially with a riband.

930. Without ſuch an artful ſtructure as this, the tendon of the perforans would have been continually expoſed to compreſſions and contuſions by the ſides of an ordinary fiſſure; without paſſing through the tendon of the perforatus, it could not have been inſerted in the middle of the flat ſide of the third phalanx, but near one of the edges.

931. In the inſertion of theſe two tendons of the phalanges, we may obſerve ſtill a farther contrivance. This inſertion is angular in both, that is, the extremities of the tendons are not inſerted according to their breadth, in a tranſverſe line, but the ſides of their breadth make an angle with the middle. I omitted this circumſtance in the deſcription, for fear of running out to too great a length, a treatiſe which is deſigned more for inſtruction than for curioſity.

Extenſor digitorum communis.

932. The extenſor digitorum communis ſerves to extend the four fingers, to keep them in any degree of extenſion, and to moderate their flexion in all the determinate degrees of action of the perforatus and perforans. The compoſition of the fibres of this muſcle, and its diviſion into ſeveral ſubaltern muſcles, are much the ſame with what we have already ſeen in the two former. Each of theſe ſubordinate muſcles may act ſeparately, but with more difficulty than the other two, becauſe of the collateral ſeries between the tendons.

933. The particular uſe of theſe communicating portions, is to move the fingers laterally, when extended, to draw them nearer or to a greater diſtance from each other, and alſo to ſerve as fræna inſtead of vaginæ. Theſe motions being unneceſſary when the fingers are bent, the perforatus and perforans have none of theſe communicating portions.

934. Each tendon ſerves to extend a whole finger, that is, all the three phalanges together; and likewiſe each phalanx by itſelf, though not with the ſame facility. The three phalanges being bent, we can eaſily extend the firſt without

the other two, but it is difficult to extend the ſecond phalanx without extending the third.

935. The contrivance for the general extenſion of the three phalanges by one tendon, conſiſts chiefly in the rhomboidal fiſſure in that tendon on the ſecond joint, or that of the ſecond phalanx with the firſt, and in the tendinous expanſions on the ſides of the baſes of the firſt phalanx. To theſe we muſt add a ſhort tendinous production from the inſide of the tendon near the firſt angle of the rhomboidal fiſſure, inſerted in the baſis of the ſecond phalanx. This production I omitted in the deſcription.

936. The lateral expanſions extend the firſt phalanx, the production juſt mentioned extends the ſecond, and the laſt angle of the rhomboidal fiſſure, the third; two other angles being kept ſeparate by auxiliary muſcles, of which hereafter.

937. The difficulty we find in extending the ſecond phalanges without extending the third, and in extending the third without the ſecond, is partly owing to the two ſtrong flexors inſerted in theſe phalanges, which are ſeldom contracted or relaxed ſeparately without a particular habit; and it is for the ſame reaſon that we cannot eaſily bend one of theſe phalanges without bending the other, except we have been long accuſtomed to it.

Extenſores indicis et minimi digiti proprii.

938. The proper extenſors of the fore and little fingers are aſſiſtants to two ſubaltern muſcles of the extenſor communis that go to theſe fingers; which conſequently we extend ſeparately with more eaſe, than either of the other two. Theſe muſcles likewiſe ſerve to bring the fingers in which they are inſerted nearer the other fingers.

939. We may be convinced of this laſt uſe, by touching theſe muſcles when we hold our fingers cloſe together, or move them laterally, whether extended, or in any other unconſtrained poſture between extenſion and flexion. The ſame experiment may be made with relation to the middle and ring fingers.

Remarks on the ſituation of the long muſcles which lie upon the fore-arm.

940. Among the long muſcles which cover the bones of the fore-arm, thoſe which extend the carpus and fingers are fixed in the outer condyle of the Os Humeri, or

near it on the ſame ſide. Thoſe which bend the ſame parts, are fixed in the internal condyle, or near it on the ſame ſide.

941. This diſpoſition is very favourable to the action of the pronators and ſupinators, which otherwiſe muſt have been obſtructed, and theſe muſcles muſt likewiſe have hindered the action of the flexors and extenſors; and they would mutually have been expoſed to contuſions and bruiſes.

942. For were the flexors fixed on the ſide of the external condyle, they muſt croſs over the radius, becauſe of their inſertions near the palm of the hand; and if the extenſors were fixed near the internal condyle, they muſt croſs over the ulna in pronation, and in that caſe could not act freely.

Flexor pollicis longus.

942. The flexor pollicis longus ſerves chiefly to bend the third phalanx of the thumb in which it is inſerted by the extremity of its tendon. It likewiſe bends the ſecond phalanx, by virtue of the ligamentary vagina through which it paſſes, as through an annular ligament.

944. As the fleſhy body of this muſcle is very thin and narrow, it does not at firſt ſight appear to bear a ſufficient proportion to the great force with which we conſtantly find it to act. But when we conſider its ſtructure more narrowly, we find therein a beautiful example of a very great number of fibres, artfully placed in a ſmall ſpace, only by the oblique diſtribution thereof; as I obſerved in the beginning of this treatiſe of the muſcles, No. 14. 54. 55.

Extenſores Pollicis.

945. The firſt extenſor of the thumb alone, when there are three, or a portion of the firſt, when there are but two, ſerves to draw the firſt phalanx from the palm of the hand, or to keep it at a diſtance therefrom.

946. The word *extenſion* made uſe of to expreſs this motion is very improper; for the firſt phalanx of the thumb in its natural ſituation makes an angle with the radius, and conſequently is in a ſtate of flexion. It ought therefore more properly to be ſaid to be extended when it is drawn near the palm of the hand. However the common terms may ſtill be retained, if we be previouſly made acquainted with their true meaning, as I already obſerved, ſpeaking of the uſes of the ulnaris and radialis externi.

947. The ſecond of theſe muſcles when there are three,

or

or the ſecond portion of the firſt, when there are but two, ſerves to extend the ſecond phalanx on the firſt, and this motion is a true extenſion.

948. The third, when there are three, or the ſecond, when there are but two, extends the third phalanx on the ſecond.

949. When they act all together, they aſſiſt each other by the graduated inſertions of their ſmall ſubaltern tendons.

950. Theſe muſcles may likewiſe aſſiſt in the common action of the two radiales, that is, in bringing the great or inner edge of the hand towards the convex ſide of the radius; and they probably have ſome ſhare likewiſe in the motion of ſupination.

§ 7. *Uſes of the ſmall muſcles inſerted in the bones of the metacarpus and fingers.*

Thenar. 951. The thenar, by its inſertion in the firſt phalanx of the thumb, ſerves to draw it from the firſt bone of the metacarpus, more or leſs directly, as one of its portions acts more than the other, or as they both act equally.

952. By the inſertion of the large portion in the baſis of the ſecond phalanx by the intervention of the ſeſamoide bone of the ſame ſide, it may bend this phalanx laterally on the firſt, and thereby bring the thumb to a greater diſtance from the index. Neither does this diſtance hinder it from ſometimes bending, and ſometimes extending the thumb in the ordinary manner.

953. When the ſmall portion acts alone, it may give the ſecond phalanx a ſmall degree of rotation on the firſt, theſe two bones not being articulated by a ginglymus.

Meſothenar. 954. The Meſothenar moves the firſt phalanx of the thumb towards the hollow of the hand, more or leſs obliquely, as it acts either alone or with the large portion of the thenar, or even with the antithenar. By its inſertion in the ſeſamoide bone of the ſecond phalanx, it likewiſe moves that phalanx on the firſt, and thereby aſſiſts the flexor longus.

Antithenar. 955. The antithenar moves the firſt phalanx of the thumb toward the firſt bone of the metacarpus,

carpus, and thereby preſſes the thumb laterally againſt the index. This motion becomes more or leſs oblique by the co-operation of the meſothenar.

Hypothenar minor.

556 The hypothenar minor ſerves to ſeparate the little finger from the reſt; which motion is commonly called *abduction*. It likewiſe keeps this finger ſeparated in all ſituations, that is in all degrees of flexion or extenſion.

Interoſſei.

957. The interoſſei may have two different uſes according to their different inſertions, and the different ſituations of the fingers in which they are inſerted.

958. In general, they aſſiſt the extenſor communis by their inſertions in the lateral angles of the rhomboidal fiſſures; for thereby they act like lateral ropes, which, together with the tendons of the extenſor, ſerve to extend the third phalanx of each finger.

959. By the ſame lateral inſertions they perform the lateral motions of the fingers, that is, they preſs them all cloſe againſt each other, but do not ſeparate them all, nor move each finger in particular towards or from the thumb. In a general ſeparation of all the fingers, the interoſſei move only the middle and ring fingers; the index and little finger being ſeparated by other muſcles. In the motion of the fingers toward the thumb, which is termed *adduction*, they act only on three fingers, the middle, ring, and little fingers. In the contrary motion, or abduction of the fingers, they move likewiſe three *viz.* the index, middle, and ring fingers.

960. The uſes of the interoſſei in particular, whether external or internal, may be different in different ſubjects, according to the variety of their inſertions, and therefore in living bodies nothing can be determined about them.

961. According to the ſituation in which I have deſcribed them, the firſt and ſecond external interoſſei perform alternately the adduction and abduction of the middle finger; the third performs the abduction of the ring finger; that is, moves it toward the little finger.

962. The firſt internal interoſſeus makes the abduction of the index, or moves it toward the middle finger; the ſecond makes the adduction of the ring finger, by moving it likewiſe toward the middle finger; and the third performs the adduction

tion of the little finger, or moves it toward the middle finger.

963. Heiſter in his Compendium Anatomicum publiſhed 1727, p. 316. makes me ſay that the internal interoſſei, by their inſertions in the ring and little finger, perform the abduction of theſe fingers; adding, that he does not conceive how an internal interoſſeus muſcle can perform the abduction of the little finger, ſince by that term anatomiſts underſtand a motion from the thumb. He quotes for this, the memoirs of the royal academy for the year 1720, but it is plain he had not ſeen the Paris edition, and that in that which he conſulted, *b* had been ſubſtituted for *d*.

Semi-interoſſeus indicis.

964. The uſe of the ſemi-interoſſeus indicis is to move the firſt phalanx of the index more or leſs directly toward the great edge of the metacarpus, by removing it from the middle finger. This motion is not a true adduction of the index toward the thumb. And indeed the terms of adduction and abduction are very improper to convey a juſt idea of the lateral motions not only of the index, but of all the other fingers.

Lumbricales.

965. The Lumbricales, by the union of their tendons with thoſe of the interoſſei, are coadjutors to theſe muſcles, not only in the lateral motions of the four fingers, but alſo in bending and extending them. In the lateral motions, they co-operate according to their ſituation in each ſubject; and it is poſſible, that the variety of their inſertions anſwer to that of the interoſſei, ſo that the reciprocal co-operation continues ſtill to be equal.

966. They aſſiſt the great common flexor to which they are fixed, only in bending the firſt phalanges; which motion that muſcle principally performs by means of the ligamentary vaginæ, eſpecially that portion of them which is next the metacarpus.

967. They may aſſiſt the extenſor communis in extending the third phalanges, together with the interoſſei, by the concurrence of their tendons. But here the variety of their inſertions is likewiſe to be regarded; and in ſome ſubjects the want of them in that ſide of the index next the thumb, and ſide of the little finger furtheſt from the thumb, may be ſupplied by the proper extenſors of theſe fingers.

§ 8. *Uſes of the muſcles which move the Os Femoris on the pelvis.*

Glutæus maximus.

968. The glutæus maximus ſerves chiefly, by its poſterior portion, to extend the Os Femoris, and to draw it backward. Neither of the other glutæi can have this uſe, though it is commonly attributed to all the three. By its anterior portion, it may co-operate with the reſt in performing the abduction of the thigh, that is, in ſeparating it from the other when we ſtand; but when we ſit, it can do this office only by its poſterior portion.

969. By its inſertion in the Os Coccygis, it may on ſome occaſions bring it forward, and hinder it from being thruſt too far backward, as in the excretion of hardened fæces, or in difficult births.

Glutæus medius.

970. The glutæus medius is commonly, but falſely reckoned an extenſor of the thigh. Its uſe is to ſeparate one thigh from the other, when we ſtand, and that more or leſs directly according to the action of its anterior, poſterior, or middle portions. In this ſituation therefore it is a true abductor, but by only viewing its inſertions we may be aſſured that it cannot be an extenſor.

971. When we ſit, the only uſe of this muſcle is to perform the rotation of the Os femoris about its axis, in ſuch a manner, that if the leg be bent at the ſame time, it ſhall be ſeparated from the other. This rotation is not altogether direct, but muſt be more or leſs oblique, becauſe of the crookedneſs of the bone, and of the angle which its head makes with the body.

Glutæus minimus.

972. The glutæus minimus has likewiſe been reckoned an extenſor of the thigh, but without any foundation. It aſſiſts the glutæus medius in the abduction of the thigh when we ſtand, and in the rotation when we ſit. Therefore of theſe three muſcles commonly called *extenſors* of the thigh, only one deſerves that name.

Remarks on the uſes of the glutæi.

973. What I have ſaid of the uſe of theſe muſcles when we ſtand, will equally hold in all other ſituations in which the thighs are ſtretched out; as for inſtance, when we lie at full length.

And what has been ſaid of their uſes when we ſit, will agree to all other ſituations in which the thighs are bent, as when we lie with the knees drawn up toward the abdomen.

974. The glutæi not only perform theſe motions of the thigh on the pelvis, but reciprocally move the pelvis on the thighs in the ſame manner. The glutæus maximus, for inſtance, not only extends the Os Femoris, but ſuſtains the pelvis on the thighs, and hinders it from being carried along with the reſt of the trunk when the body is inclined forward, while we ſtand; and likewiſe raiſes it, when the reſt of the body is raiſed.

975. The other two glutæi likewiſe move the pelvis on the thigh as they move the thigh on the pelvis. For inſtance, when we ſtand upon one leg, the two muſcles on that ſide draw the pelvis laterally toward the thigh, and hinder it from giving way or falling toward the other ſide, whether the weight of the pelvis itſelf, and of the other leg which is not ſupported, endeavours to bring it.

Pſoas. 976. The pſoas bends the thigh on the pelvis, or brings it forward. It may likewiſe move the pelvis on the thighs, and hinder it from being carried along with the reſt of the trunk, when the body is inclined backward while we ſit, having the lower extremities fixed by ſome external force. In this ſituation it may likewiſe move the vertebræ of the loins.

Iliacus. 977. The iliacus is a congener or aſſiſtant to the pſoas, in bringing the thigh forward and upward. It may likewiſe move the pelvis in the ſame manner with the former.

Pectineus. 978. The pectineus is an aſſiſtant to the two former muſcles in moving both the thigh and the pelvis. It may likewiſe aſſiſt in bringing the thigh inward, or toward the other, whether it be extended or bent at the ſame time.

Tricipites. 979. The three triceps muſcles join in the ſame uſe, that is, to move the thigh inward, and bring the two thighs near each other; as when in riding, we preſs the thighs cloſe againſt the ſaddle; when in ſitting, we hold any thing cloſe between the knees; when we croſs the thighs; or when in ſtanding, we bring the legs cloſe together in order to jump.

980. The uſe of theſe muſcles is likewiſe to hinder the thighs from ſeparating more than is convenient, eſpecially in great efforts and jerks. This might happen, for inſtance, when in mounting a horſe, or laying the leg over any height, we raiſe one thigh haſtily, and ſupport the body on the other. It might likewiſe happen by the weight of the body alone, when in ſtanding we ſeparate both legs at once, or jump haſtily to one ſide.

981. This uſe of bringing the thighs together, and hindering their ſeparation, has place in all poſſible ſituations of the body or thighs, that is, in ſtanding, ſitting, and lying, and when bent, extended, or turned backward or outward. This ſhews the great neceſſity of providing for this function, not only by adding moving force, but alſo by diſtributing this force in ſuch a manner, as that it may be able to act through almoſt all the degrees of a very long lever of one kind.

982. The longeſt portion of the triceps tertius being inſerted in the ſide of the inner condyle of the Os Femoris, ſeems to counterbalance the other portions which are inſerted more poſteriorly in the linea aſpera.

Pyriformis gemelli, & quadratus.

983. Theſe four muſcles, called likewiſe by the common name of *quadrigemini*, are congeneres in their uſes; and theſe have been confined by anatomiſts to the rotation of the Os Femoris about its axis from before outwards. I demonſtrated many years ago, that they cannot have this uſe, except when we ſtand or lie at full length; and likewiſe that in ſitting, or when the thigh is bent in any other poſture, they carry the thigh outward, or ſeparate the two thighs from each other when bent.

984. All the four co-operate in theſe two uſes of rotation and abduction; but they co-operate equally or unequally, according to the different degrees of the extenſion or flexion of the thigh. For inſtance, when we ſtand ſtraight up, they all perform the rotation equally; but if the thigh be then carried a little forward, the pyriformis is more in action than the quadratus; and if the thigh be carried backward, the quadratus acts moſt.

985. Theſe muſcles, by means of their adheſion to the orbicular ligament of the joint of the hip, may likewiſe ſerve

to hinder that ligament from being ſqueezed between the bones in the different motions of the thigh.

Obturator internus.

986. The obturator internus has nearly the ſame uſes with the quadrigemini, in making the rotation of the thigh when extended, and the abduction, when bent. But the mechaniſm of this muſcle is ſingular in this reſpect, that, by the paſſage of its tendon, over the ſmall iſchiatic notch, it acquires a different direction from that of the belly or fleſhy body.

987. This notch ſupplies the place of a pulley, over which a rope is thrown, one end of which is faſtened to a moveable object, which, by pulling the other end, may be brought nearer the pulley. In this the pulley performs the office of a fixed point or fulcrum with reſpect to the moveable body; and in like manner the iſchiatic notch is a fulcrum for the motion of the thigh by the obturator internus.

Obturator externus.

988. The obturator externus concurs with the internus in the ſame uſes, though in a more ſimple manner, and in a more uniform direction. It acts chiefly when the thigh is extended more or leſs; for when the thigh is bent, it only ſeems to co operate with the obturator internus in its action on the orbicular ligament; becauſe in other reſpects, it is rather an aſſiſtant to the triceps, and performs the motion of rotation the other way.

Muſculus faciæ Latæ.

989. The muſculus faſciæ latæ has been falſely ſuppoſed to be an abductor of the thigh; for the direction of its moving fibres is very contrary to ſuch a motion. It is very proper for making a rotation from before inwards, that is, in a contrary direction to that made by the quadrigemini and obturator internus; and this rotation is not ſo much confined as that of the quadrigemini. becauſe it may have place whether the thigh be bent or extended.

990. It may likewiſe aſſiſt in the great efforts of flexion or adduction, provided that its different antagoniſts act as moderators, according to the different ſituations of the thigh, as ſhall be explained at more length in another place.

§ 9. *Uſes*

§ 9. *Uſes of the muſcles which move the bones of the leg on the Os Femoris.*

991. To be able to conceive the uſes of theſe muſcles, we ought firſt to be well inſtructed in all that relates to the bones concerned, eſpecially their articulations and intermediate cartilages, as I have deſcribed them in the treatiſe of the ſkeleton, and of the freſh bones; and in particular, I deſire the reader to review the deſcription of the Os Femoris, tibia, and patella.

Vaſtus externus, vaſtus internus, and crureus.

992. The two vaſti and crureus ought to be looked upon as a true triceps, the uſes of which, in relation to the bones, are only to extend the tibia on the Os Femoris, and the Os Femoris on the tibia. The extenſion of the tibia on the Os Femoris, happens chiefly when we ſit or lie, and that of the Os Femoris on the tibia, when we ſtand or walk. All the three muſcles move the patella uniformly in the direction of the Os Femoris, on the pulley at the lower extremity of that bone. The external or broad portion of this pulley and of the patella, anſwers to this direction, and ſeems to be more expoſed to the action of theſe muſcles, than the internal and narrow portion on which the neceſſary obliquity of that pulley depends.

993. The inſertion of both the vaſti immediately in the head of the tibia, prevents the patella from being luxated laterally on ſome occaſions, in which the muſcles may act with more force on one ſide than on the other, or remain without action, in which caſe the patella is looſe and floating.

994. To be convinced of this inaction, and of the moveableneſs of the patella at the ſame time, let us, either in ſitting or ſtanding with the leg extended, reſt the leg only upon the back ſide of the heel, ſo as that the whole lower extremity may be ſupported on the heel and on the head of the Os Femoris, the knee and the body of the Os Femoris reſting on nothing, and the extenſion being made only by the weight of the bones without any aſſiſtance from the muſcles. If, in this ſituation, we lay the thumb on the baſis of the patella and the fore-finger on the apex, and preſs theſe two parts alternately,

ternately, the patella will be perceived to be raiſed and depreſſed.

995. In the deſcription of theſe muſcles, I forgot an obſervation which I have made on the inſertion of ſeveral fibres immediately in the capſular ligament of the joint of the knee. I have ſeen theſe fibres run down, as if they came chiefly from the crureus; and their inſertion in the ligament was oblique, and made by degrees. And from hence I firſt took the hint of that new ſpecies of muſcles already mentioned in deſcribing thoſe which ſurround the articulation of the head of the Os Humeri, of the ulna, and of the Os Femoris; and in ſome articulations the adheſion of the tendons or tendinous fibres ſupplies the place of fleſhy fibres.

996. By the inſertion of theſe muſcles in the patella, their line of direction is removed to a greater diſtance from the centre or axis of motion of the joint, which facilitates their action, and defends their common tendon from compreſſion and contuſions.

Rectus anterior.

997. The rectus anterior by its inſertion in the patella is a congener to the laſt three muſcles, and ſerves to extend the leg. By its inſertion in the Os Ilium, it bends the thigh and aſſiſts the pſoas iliacus, and pectineus, whether the leg be extended or bent. It likewiſe moves the pelvis forward on the Os Femoris, and hinders it from falling back when we ſit.

998. Being partly penniform and partly ſimple, it is capable of ſuſtaining great efforts, and of producing large motions; and its line of direction which is raiſed to a conſiderable diſtance from the centre of motion of the hip and knee, increaſes theſe advantages. The particular diſpoſition and largeneſs of its ſecond ſuperior tendon, anſwer principally to all the degrees of flexion.

999. The other tendon commonly deſcribed, would not alone have been ſufficient for that purpoſe; but its obliquity is convenient for the extenſion of the leg, when the thigh is extended or but little bent. But when the thigh is very much bent, this obliquity would remove the ſmall tendon to too great a diſtance from the bone, and thereby expoſe it to be torn off, in the ſame manner as we tear off the branch of a tree, by ſeparating it from the trunk. The obliquity here

mentioned, is with reſpect to the Os Femoris, this ſuperior tendon lying out of the direction of that bone.

Sartorius.

1000. The ſartorius performs the rotation of the thigh from before, outward, whether extended or bent, being an antagoniſts to the muſculus faſciæ latæ, and a congener to the quadrigemini.

1001. If during this rotation the leg be extended, the toes are turned outward; but if the leg be bent, it is turned toward the other leg, as when we lay it over the other leg or knee, in the manner that tailors ſit at work, from whence this muſcle got the name of *ſartorius*.

1002. It likewiſe bends the thigh or raiſes it forward; it moves the pelvis forward on the Os Femoris, and when the pelvis reſts on the two tuberoſities of the iſchium in ſitting, it keeps it in that ſituation. In this action it is a congener to the rectus anterior, but acts with much more force, as having its line of direction further from the centre of motion.

1003. Laſtly, it bends the leg, whether it performs the rotation of the thigh at the ſame time or not. In this latter caſe, it is directed by the co-operation of ſome congener, or counterbalanced by the action of the muſculus faſciæ latæ.

1004. The length and obliquity of its fleſhy portion, the paſſage of the inferior tendon through the aponeurotic vagina, the particular inſertion of this tendon, and the extent of the aponeuroſis which it ſends over the tibia, contribute very much to theſe different uſes.

1005. Beſides all theſe uſes, it may in ſome caſes aſſiſt the popliteus, as ſhall be ſhewn in ſpeaking of that muſcle.

Gracilis internus.

1006. The gracilis internus bends the leg much in the ſame manner with the ſartorius which it aſſiſts in this function, but not in that of turning the leg; and it is more proper to continue the flexion than to begin it, it being chiefly when the thigh is turned by the ſartorius, that the gracilis contributes to this action.

1007. It may likewiſe aſſiſt the triceps in the adduction of the thigh, which it performs with much more facility than it begins the flexion of the leg without the rotation of the thigh. This facility in all ſituations of the thigh, is procured by the diſtance of the ſuperior inſertion of this muſcle from the joint of the hip; but it cannot with the ſame eaſe bend the leg when the thigh is not turned, for this reaſon.

1008. While the thigh is only extended, the line of direction of this whole muſcle is nearly in the ſame plane with the axis of motion of the knee, and therefore the diſtance of its ſuperior inſertion gives it no advantage. But when the thigh is turned round by the ſartorius, the plane of its direction changes and croſſes the axis of the ginglymus of the knee, and then the lateral diſtance of its ſuperior inſertion facilitates its action on the leg.

Semi-nervoſus.

1009. The ſemi-nervoſus bends the leg, and may likewiſe bend the thigh on the leg. By its inſertion in the tuberoſity of the iſchium, it likewiſe extends the thigh on the pelvis, and carries it backward; and may alſo extend the pelvis on the thigh, when it has been inclined forward with the reſt of the trunk; and conſequently prevent its being carried too far along with the trunk, when we ſtop forward, either ſtanding or ſitting.

Semi-membranoſus.

1010. The ſemi-membranoſus has the ſame uſes with the ſemi nervoſus. It bends the leg on the thigh, and the thigh on the leg; it extends the thigh on the pelvis, and the pelvis on the thigh, and ſuſtains the pelvis when it is inclined forward. It differs in this one thing from the three muſcles laſt mentioned, that its inſertion is not on one ſide, but behind the joint; and for that reaſon it is better diſpoſed both to begin and continue the flexion of the leg than they are.

Biceps.

1011. The two portions of the biceps bend the leg on the thigh, and the thigh on the leg. The ſuperior portion likewiſe extends the thigh on the pelvis, and the pelvis on the thigh. Theſe four uſes in general are common to this muſcle with the ſemi-membranoſus, and in ſome meaſure with the ſemi-tendinoſus.

1012. The particular uſe of the biceps, and which ſeems to belong more to the ſhort portion than to the other, is to perform the rotation of the leg when bent, by which motion the toes are turned outward, and the heel inward. It has no ſhare in the rotation of the leg when extended, which depends entirely on that of the thigh. the motions of which, the leg only follows, as if theſe two bones were cemented together.

1013. The mechaniſm of the rotation of the leg when bent, depends chiefly on the ſtructure of the ſemi-lunar cartilages,

tilages, and on the ſituation of the lateral and crucial ligaments. Theſe cartilages are hollowed on the upper ſide in proportion to the convexity of the condyles of the Os Femoris; and on the under ſide they are flattened in proportion to the ſurface of the tibia. The lateral ligaments are not in the middle of each ſide of the head of the tibia, but more backward. The crucial ligaments are diſpoſed in ſuch a manner, as that in turning the leg when bent, from before outward, they ſeparate from each other, and in turning it from before inward, they approach each other. See the deſcription of the freſh bones, N° 154. 160. 162.

1014. When the leg is extended or bent, the ſemi-lunar cartilages perform the office of hinges, becauſe the condyles of the Os Femoris turn in their cavities; and in this caſe theſe cartilages may be conſidered as making in ſome meaſure but one piece with the tibia. And when the leg is ſtrongly extended, the lateral ligaments, by their ſituation backward, limit this extenſion, and hinder the leg from being bent forward.

1015. In making the two motions of rotation with the leg when bent, the ſemi-lunar cartilages may be conſidered as being fixed to the Os Femoris, and that the tibia ſlides both ways under them. In this caſe, the lateral ligaments are very much relaxed, and nowiſe hinder this rotation; and the crucial ligaments ſeparate from each other, when we turn the toes outward, the leg being bent; but they ſtrike againſt each other, when the toes are turned inward, which ſeems to render the rotation inward, more confined than the rotation outward.

1016. Theſe two reciprocal motions of the leg when bent, may be compared to thoſe of the radius on the ulna. The rotation inward anſwers to pronation, and the rotation outward to ſupination. The biceps of the tibia may be likewiſe compared to the biceps of the fore-arm, both being flexors and rotators; for pronation and ſupination are only two ſpecies of rotation.

1017. The want of motion in the fibula on theſe occaſions, is made up by the moveableneſs of the patella; without which the rotation of the leg, when bent, would be impoſſible; for in making this motion, the patella remains perfectly at reſt on the condyles of the Os Femoris; the great ligament only giving way by a ſort of ſmall reciprocal contorſion of its lower extremity. It is neceſſary here to review what was ſaid in the deſcription of the ſkeleton.

Popliteus. 1018. The popliteus performs the rotation of the leg when bent, in a direction contrary to that of the biceps The biceps turns the leg from before outward; the popliteus from before inward. This rotation therefore anſwers to the pronation of the radius by the pronator teres, as that made by the biceps tibiæ does to the ſupination made by the biceps of the arm.

1019. This muſcle is commonly reckoned among the flexors of the leg; but it ſeems very ill contrived for ſuch a function, becauſe of the obliquity of its ſituation, and becauſe its inſertion is ſo near the centre of motion of the joint. By its connection with the capſular ligament, it may ſerve to prevent its being catched between the two bones in the flexions of the leg.

§ 10. *Uſes of the muſcles which move the tarſus and the other bones of the foot.*

Tibialis Anticus. 1020. The tibialis anticus bends the foot, that is, turns the point of the foot toward the leg, which motion is performed by the ginglymoide articulation of the aſtragalus with the tibia and fibula. It likewiſe bends the leg on the foot, or hinders its extenſion. The firſt of theſe uſes is generally known; and we have an inſtance of the ſecond every time we ſtand or walk. When we ſtand, the feet being turned directly forward, this muſcle, like a frænum, keeps the leg in æquilibrio, and hinders it from falling backward. This uſe is ſtill more evident when we walk backward.

1021. By its lateral inſertion in the Os Cuneiforme maximum, it moves this bone in particular over the anterior extremity of the Os Calcis; by which the ſole of the foot is turned inward, toward the other. This lateral ſituation of its inſertion is the reaſon why it cannot bend the foot directly, without the help of the anterior peronæi; neither can it alone keep the leg in æquilibrio when we ſtand on one foot.

Peronæus medius et minimus. 1022. The peronæus medius bends the foot, and hinders the leg from falling back in the ſame manner as the tibialis anticus. By its inſertion in the tuberoſity of the fifth metatarſal bone, it turns the ſole of the foot outward at the ſame time that it bends it, when it acts without the aſſiſtance of the tibialis anticus; the co-operation of which muſcle is likewiſe neceſſary to enable it to counterbalance the force with which the leg would be carried backward, when we ſtand upon one foot.

1023. The peronæus minimus is an aſſiſtant to the medius in the flexion of the foot, in preſerving the æquilibrium of the leg, and in turning the ſole of the foot outward; neither can it perform the firſt two of theſe motions uniformly without the co-operation of the tibialis anticus.

1024. The uniform flexion of the foot furniſhes an example of all the three kinds of levers; of the firſt, when we bend the foot while off the ground, in which caſe the fulcrum is in the articulation between the two extremities of the lever; of the ſecond, when we walk upon the heels or toes, for then the weight is between the power and the fulcrum; of the third, when we raiſe a weight by the toes, for then the power is between the weight and the fulcrum.

Gaſtrocnemii et ſoleus.

1025. The gaſtrocnemii and ſoleus make a kind of triceps, and by their common tendon extend the foot and keep it extended againſt the ſtrongeſt reſiſtance. It is by their means that we raiſe the whole body even with an additional burden, when we ſtand a tip-toes; and that we walk, run, and jump. The length of the poſterior portion of the Os Calcis gives them a great advantage in acting, by removing the line of their direction from the axis of motion.

1026. The motions of the foot performed by theſe muſcles may be referred to the firſt two kinds of levers. When we ſtand a tip-toes, the foot repreſents a lever of the ſecond kind the fulcrum being then at one end, the power at the other, and the weight between them; and we have a lever of the firſt kind, when the leg being fixed, we endeavour to overcome any moveable reſiſtance with the toes, or whenever we move the foot held off the ground.

1027. Theſe muſcles not only extend the foot on the leg but likewiſe the leg on the foot, as appears evidently when after a moderate genuflexion we raiſe our bodies; for then the foot remains fixed while theſe muſcles extend the leg; and it is here to be obſerved, that this genuflexion is not made by the action of any flexors, but only by the relaxation of the proper extenſors, according to what was taken notice of in the beginning of this ſection, N° 51.

1028. The gaſtrocnemii, by their inſertion in the Os Femoris, may in great efforts move the leg on the thigh, and the thigh on the leg, as aſſiſtants to the biceps, ſemi-membranoſus, ſemi-tendinoſus, gracilis internus, and ſartorius. In theſe motions the ſuperior extremities of the gaſtrocnemii croſs under the lower extremities of the muſcles laſt named. The fleſhy fibres of the gaſtrocnemii are very long, and there is a great diſtance between their two inſertions; and, on this account, theſe muſcles are better fitted for large degrees of motion than for ſtrength.

1029. The ſoleus, by the multitude of its fleſhy fibres and its penniform ſtructure is more proper for ſtrong than large motions, and ſeems principally to ſuſtain the gaſtrocnemii in the motions begun by them. The tendinous portions of this muſcle and of the gaſtrocnemii, though they form a ſtrong tendon all together, ſeem nevertheleſs to ſlide a little upon each other in the different flexions and extenſions of the foot.

Tibialis gracilis vulgo plantaris.

1030. From the deſcription of the tibialis gracilis we ſee evidently that it can have no uſe with relation to the ſole of the foot. The uſe aſſigned to it by others of extending the tarſus, and thereby aſſiſting the gaſtrocnemii and ſoleus, ſeems to me to be very uncertain, both becauſe of the great diſproportion in its ſize, and the obliquity of its courſe. If the ſoleus were not covered by the gaſtrocnemii, the tibialis gracilis might be imagined to ſerve as a frænum in bracing down that muſcle, and hindering it from ſwelling too much; but the ſmall number and direction of its fibres, would ſtill render it unfit for that function.

1031. Till its true uſe is evidently diſcovered by ſome lucky obſervation, there is in the mean time ſome ground to think that it hinders the capſular ligament of the knee from being compreſſed in the flexion of that joint; both becauſe of its adheſion to that ligament, and becauſe of the obliquity of its courſe, eſpecially ſince the neighbouring portion of the ſame ligament ſeems to receive the ſame aſſiſtance from a tendinous expanſion of the ſemi-membranoſus.

Tibialis poſticus.

1032. When the tibialis poſticus acts alone, it extends the foot obliquely inward. When it acts together with the gaſtrocnemii and ſoleus, it changes the ſtraight direction of their motion to an oblique one. When it acts with the tibialis anticus, the ſole of the foot is turned more directly inward or toward the other foot.

Peronæus maximus.

1033 When the peronæus longus or maximus acts alone, it may extend the foot hanging freely in the air; but then this extenſion is obliquely outward. Together with the gaſtrocnemii and ſoleus, it likewiſe changes their direction to an oblique extenſion outward.

1034. This muſcle, and the tibialis poſticus acting without the gaſtrocnemii and ſoleus, may extend the foot almoſt directly, but they can overcome but a very ſmall reſiſtance. When it acts with the other two peronæi, the ſole of the foot is turned more or leſs directly outward toward the external malleolus.

1035. I cannot help repeating once more, that in order to conceive theſe uſes as we ought, it is very neceſſary to review the deſcription of theſe muſcles, and what was ſaid concerning the mechaniſm and uſes of the bones of the tarſus.

Extenſor pollicis longus, flexor pollicis longus, thenar & antithenar.

1036. The extenſor pollicis longus extends the two phalanges of the great toe; and it may likewiſe be an aſſiſtant to the tibialis anticus.

1037. The flexor pollicis longus not only bends the ſecond phalanx of the great toe, but may likewiſe ſerve in great efforts, as an aſſiſtant to the extenſors of the tarſus. This muſcle is of great uſe in climbing up a ſteep place.

1038. The thenar bends the firſt phalanx of the great toe. When the portion neareſt the inner edge of the foot either acts alone, or acts more than the reſt, the great toe is ſeparated from the other toes, eſpecially if it be at the ſame time extended. This ſeparation may be greater or leſs, according to the degrees of action of the other portions of the thenar.

1039. The antithenar acting with the thenar, bends the firſt phalanx of the great toe. When it acts alone, eſpecially if the great toe is bent, it brings it nearer the other toes, in proportion to the degrees of action of its different portions.

Extenſor digitorum longus & brevis.

1040. The two extenſors digitorum communes concur in extending the four ſmall toes; and as the extenſor longus is not near ſo fleſhy as that of the hand, this difference is made up by the extenſor brevis. The longus alone ſeems to extend the firſt phalanges; and they both join in the extenſion of the ſecond and third phalanges; the brevis by the obliquity of its direction moderating the action of the longus, which otherwiſe would have turned the toes obliquely the contrary way.

1041. The extenſor longus may likewiſe aſſiſt the tibialis anticus, and peronæus anticus in great efforts, or in keeping the foot bent; as when we would raiſe a weight upon the toes, or overcome any other reſiſtance. Laſtly, one extenſor alone would not have been ſufficient to counterbalance the common flexors.

Perforatus, perforans, flexor acceſſorius & lumbricales.

1042. The perforatus or flexor digitorum brevis, bends the ſecond phalanges; and the perforans or flexor longus, the third; the uſe of theſe muſcles being nearly the ſame with thoſe of the perforatus and perforans of the hand.

1043. The flexor acceſſorius, which might very juſtly be termed *plantaris*, is an aſſiſtant to the perforans, increaſing its force on ſome occaſions. It likewiſe directs the tendon of that muſcle; for by contracting at the ſame time that the fleſhy belly of the perforans is in action, it makes the tendons go in a ſtraighter line to the toes than they would otherwiſe do, becauſe of their obliquity. It has likewiſe another uſe with relation to the lumbricales.

1044. The lumbricales have nearly the ſame functions in the foot as in the hand; and they are partly aſſiſted and partly directed by the flexor acceſſorius.

Interoſſei.

1045. The interoſſei of the foot have the ſame uſes as in the hand. The firſt ſuperior muſcle brings the ſecond toe near the great toe; the other three bring the ſecond, third, and fourth toes near the little toe.

The three inferior muſcles move the laſt three toes toward the other two. I here ſpeak according to the ſituation which I have moſt frequently obſerved; but as that ſituation varies, the uſes muſt likewiſe be different.

1046. The metatarſius moves the laſt bone of the metatarſus, much in the ſame manner as the metacarpius does that of the metacarpus. By this action it draws likewiſe the fourth bone along with it, and contracts the ſole of the foot, increaſing the convexity of the upper ſide; provided that the foot is not become inflexible by long wearing ſtrait ſhoes, by old age, or by any other conſtraint or indiſpoſition.

Metatarſius, tranſverſalis, parathenar major & minor.

1047. The tranſverſalis may aſſiſt the metatarſius in this action, which is ſuppoſed to be of uſe to tilers in climbing. The antithenar may likewiſe concur, and the peronæus minimus may ſerve to counterbalance theſe muſcles, and to bring the metatarſus back to its natural ſituation. The common extenſors, by their neareſt tendons, may likewiſe be antagoniſts to the metatarſius and tranſverſalis.

1048. The parathenar major ſerves particularly to ſeparate the little toe from the reſt; and the parathenar minor bends the firſt phalanx of that toe. Both theſe muſcles ſeem to be too large and ſtrong, for the neceſſary motions of ſo ſmall a part on ſo weak a joint. But as the little toe makes a part of the outer edge of the ſole of the foot, which is very much expoſed to external violence when we walk barefooted, and no part of it ſo much expoſed as the little toe, very powerful muſcles were neceſſary to ſtrengthen it on theſe occaſions.

1049. Beſides the two uſes already mentioned, the great and ſmall parathenar may have another in which they may likewiſe be aſſiſted by the thenar; and that is, to bend the ſole of the foot according to its breadth, which action is very requiſite in walking a-tip-toes, in going up a ladder, and in climbing; on which account the two parathenars deſerve the name of the tiler's muſcles, much better than the tranſverſalis pedis.

§ 11. *Uſes of the muſcles employed in reſpiration.*

1050. In deſcribing theſe muſcles, I began by the diaphragm;

phragm; but in giving their uſes, all the other muſcles muſt go before it, for a reaſon which will appear hereafter.

Scaleni. 1051. The ſcaleni ſeem better fitted for the motions of the neck than for thoſe of reſpiration; and I frankly acknowledge, that, in reflecting on this, while this page was in the preſs, I began to doubt of this latter uſe, eſpecially when I called to mind what I ſaid about the uſes of the ſubclavius, N° 822. *viz.* that I could not believe this muſcle to be employed in reſpiration, becauſe of its inſertion in the cartilaginous portion of the firſt rib, which is immoveably fixed to the ſternum, and likewiſe much ſhorter, much broader, and conſequently much leſs flexible than the cartilages of the other ribs.

1052. Moreover, the neck in many ſituations cannot ſerve as a fixed point to the ſcaleni for the motion of the ribs; as for inſtance, when it is bent forward over the ſternum, or inclined very much to either ſhoulder; and yet we find that none of theſe ſituations do in the leaſt hinder the motions of reſpiration.

1053. From this time therefore, I ſhall rank the ſcaleni among the muſcles which move the vertebræ of the neck; becauſe the articulation of the firſt rib on both ſides, with the firſt vertebra of the back, ſeems to ſerve only for the motion of that vertebra on the rib, and not of the rib on the vertebra. In this manner ought truth to be embraced whenever it preſents itſelf.

Serrati poſtici. 1054. The ſerratus poſticus ſuperior, is diſpoſed to move upwards the three or four upper ribs next the firſt. And if any portion of this muſcle ſhould be obſerved to be inſerted in the firſt rib, that could only ſerve for the motion of the vertebræ with which that rib is articulated, and not for the motion of the rib itſelf, becauſe of the ſtiffneſs and immobility of its cartilaginous portion.

1055. The ſerratus poſticus inferior is ſtill better diſpoſed for depreſſing and keeping down the laſt three or four falſe ribs.

1056. The uſe which has been aſſigned to theſe two muſcles of being vaginæ or moveable fræna to the longiſſimus dorſi and ſacro-lumbaris, is without foundation; for the portions of theſe muſcles covered by the ſerrati, have no more need of ſuch a contrivance than thoſe which are not covered by them.

1057. The poſterior fibres of the external intercoſtals, are fixed by their upper extremities ſo near the articulation of the ribs with the vertebræ, that they cannot depreſs that rib in which they are ſo inſerted; whereas the inſertions of their lower extremities in the following rib, being at a greater diſtance from the articulation, they may move that rib upward. And from thence it follows, that all the remaining part of each external intercoſtal which terminates at the bony extremity of each rib, can only ſerve to raiſe the lower rib, toward the upper.

Intercoſtales, & ſupra-coſtales.

1058. The anterior fibres of the internal intercoſtals are ſo near the articulation, of the ribs with the ſternum, that they cannot depreſs that cartilage in which each of them is inſerted; whereas the inferior inſertions of theſe fibres being at a greater diſtance from the articulation, they are in a condition to raiſe the cartilages in which they are ſo inſerted. From whence it follows, that all the internal intercoſtal muſcles have the ſame uſe with the external, and that they can have no other.

1059. The portions which lie between the two extremities of the ribs, ſerve to increaſe the force of the ſame uniform action. And the firſt rib being immoveable, ſerves for a fixed point for the motions of all the other ribs, and each rib in particular ſerves for a fixed point for the motion of that below it.

1060. The ſupra-coſtales are powerful aſſiſtants to the intercoſtals in their common action, and are therefore very juſtly termed *levatores coſtarum.* But we muſt not confound with theſe, a ſmall muſcle immediately above the firſt rib, which by its inſertion in that rib, looks like them at firſt ſight.

1061. The inſertions and direction of the ſterno-coſtales being carefully examined, it will be found that their uſe is to depreſs the cartilaginous portions, and anterior extremities of the ribs, eſpecially the ſuperior ribs, except the firſt; and at the ſame time to draw the cartilages of the inferior ribs near the ſternum, by reaſon of the curvature. They may therefore very well be called *depreſſores coſtarum*, as the ſupra-coſtales are named *levatores.*

Sterno-coſtales & ſub-coſtales.

1062. The ſub-coſtales having the ſuperior extremities of their fibres much more diſtant from the vertebral articulations of the ribs, than the lower extremities; it follows, that they can more eaſily move the upper than the lower ribs, and conſequently, that they are aſſiſtants to the ſterno-coſtales.

1003. The diaphragm, together with the intercoſtal muſcles, the ribs, ſternum, and vertebræ of the back, forms the cavity of the thorax, and it divides this cavity from that of the abdomen.

Diaphragma.

1064. Its particular uſe is to be the principal organ of reſpiration, that is, of the alternate expanſion and contraction of the thorax. The other muſcles already mentioned are to be conſidered only as aſſiſtants and directors, in order to facilitate and regulate theſe motions, which in the ordinary ſtate are perpetual, but which may, by the action of theſe other muſcles, be accelerated, retarded, or even be ſuſpended for ſome ſpace of time.

1065. The diaphragm may move, when the ribs are at reſt, and conſequently without the aſſiſtance of the muſcles which move the ribs; and this motion may be ſufficient to keep up the alternate dilatation and contraction of the thorax, without which the animal cannot live.

1066. In a word, we may continually expire and inſpire by means of the diaphragm, whether the ribs move or remain at reſt; and whether the thorax be kept for a conſiderable time in a ſtate of great dilatation or of great contraction; for this does not hinder the diaphragm from continuing its motions.

167. We cannot explain this mechaniſm, till we have firſt deſcribed ſeveral other organs on which it depends; and therefore it muſt be referred to the treatiſe of the thorax.

§ 12. *Uſes of the muſcles which move the head on the trunk.*

1068. The action of the ſterno-maſtoidæi is different, according as either both muſcles or only one of them acts, and according to the different ſituation of the head and trunk.

Sterno-maſtoidæi.

1069. When we keep the head and trunk ſtraight, whether in ſtanding or ſitting, both muſcles preſerve the head in that poſture, againſt any force by which it would otherwiſe be moved backward. This we may be convinced of, by laying the hand on theſe muſcles, while we endeavour to reſiſt a force which puſhes back the head.

1070. One of theſe muſcles acting alone, may have the ſame uſe, if the force to puſh the head back be applied between the anterior and lateral parts of it. In that caſe, the ſterno-maſtoidæus on the ſame ſide would oppoſe this force; but if it were applied directly on the ſide of the head, that oppoſition would have no effect without the aſſiſtance of the ſplenius on the ſame ſide.

1071. They both ſerve likewiſe to perform the rotations of the head, that is, to make it turn to either ſide as on a pivot; and in this caſe, when we turn the head to one ſide, the ſterno-maſtoidæus on the other ſide acts, and not that on the ſame ſide; this is an obſervation of conſequence in paralytical diſorders.

1072. They both ſerve, in the next place, to bring the head near the thorax when we lie on the back, or bend backward in ſitting. And the lower the head is in theſe ſituations, the more force muſt theſe muſcles exert to raiſe it. In this caſe the ſternum being the fixed point, muſt remain immoveable; but as its connection with the firſt rib, and the inflexibility of the cartilage of that rib, are not always ſufficient for this; the muſculi recti of the abdomen muſt lend their aſſiſtance in great efforts.

1073. In moſt people, we may feel this co-operation of the abdominal muſcles, in raiſing the head when they lie on their back, by laying the hand on theſe muſcles. But when the cartilage of the firſt rib is very much hardened, and the articulation quite deprived of motion, as where the firſt and ſecond ribs are partly confounded together, of which I have ſeen inſtances; in ſuch people, the ſternum does not want any other aſſiſtance to keep it immoveable, and therefore the co-operation of the muſcles of the abdomen would not be perceivable.

1074. When being in an erect poſture, either ſtanding or ſitting, we lower the head, the ſterno-maſtoidæi do not act, neither have they any ſhare in that poſture. It is produced only by the relaxation of the poſterior muſcles, by which alone the head is ſuſtained in this erect poſture, and without which it would naturally fall forward, as we ſee in thoſe who fall aſleep, or are taken ſuddenly ill, while ſitting.

1075. The inſertions of theſe muſcles in the poſterior part of the maſtoide apophyſes, has made ſome anatomiſts believe that they are more proper to bend the head backward than forward; their inſertions being behind the condyloide articulation of the Os Occipitis; and to this they might have added, that the neck, from the natural diſpoſition of the vertebræ, is better fitted for flexion backward than forward.

1076. But, in the firſt place, as theſe inſertions take up a great deal of room, the moveable point can only be determined to that part which is neareſt the fleſhy body, and the moſt anterior; and conſequently not ſituated ſo far back as 's imagined.

1077. In the ſecond place, as the motion of the head forward, by theſe muſcles, is diſtinct from that of the neck, the anterior muſcles of the vertebræ of the neck muſt act at the ſame time, and hinder them from bending backward; ſo that, in this caſe, the neck may be looked upon as a pillar, the upper part of which ſupports the head, while the head acted upon by the muſcles, carries the lower part of it forward. It is for want of this co-operation that experiments made on dead bodies have been apt to miſlead.

Splenius et complexus.

1078. The two ſplenii ſerve to ſupport the head in an erect poſture, whether in ſtanding or ſitting, to moderate the flexion of the head forward, and to bring it back again to its natural poſture.

1079. They ſerve alternately to co-operate with either of the ſterno-maſtoidæi for the rotation of the head; thus when the right ſterno-maſtoidæus turns the head, the left ſplenius correſponds with it by its upper part; while the lower part at the ſame time turns the vertebræ of the neck.

1080. When we lie on one ſide and raiſe the head laterally, the ſplenius and ſterno-maſtoidæus of the oppoſite ſide act in concert. Alſo when we ſtand and incline the head to one ſide, it is the ſplenius and ſterno-maſtoidæus of the other ſide which moderate that lateral flexion, and afterwards extend the head. And as the ſterno-maſtoidæus is partly inſerted in the clavicula, the latiſſimus dorſi concurs likewiſe in this action, and fixes the clavicle by means of its connection with the Os Humeri, which is of conſiderable advantage in the action of the ſterno-maſtoidæus.

1081. The complexi are aſſiſtants to the ſplenii, to keep the head ſtraight in ſitting or ſtanding, to hinder it from inclining forward, and to raiſe it when inclined. When they act together, they, as well as the ſplenii, may move the head backward, while the trunk is bent forward, or when we lie upon the belly. This latter motion is commonly named *extenſion*, the other *flexion*.

1082. When the ſplenius and complexus of one ſide act together, they may ſupport the head when obliquely inclined to the oppoſite ſide; bring it back again to its natural ſituation, and incline it obliquely toward the ſide on which they lie.

Recti poſtici, obliqui ſuperiores, &c.

1083. The recti majores and minores poſtici, and obliqui ſuperiores turn the head a little backward on the firſt vertebra of the neck; and they can neither act otherwiſe nor ſeparately. The recti majores contribute moſt to this motion; and the minores ſeem likewiſe to hinder the articular membranes from being pinched between the bones in great motions.

Recti antici et tranſverſales antici.

1084. The recti majores and minores and antici, and the two tranſverſales antici move the head forward on the firſt vertebra; and the recti minores and tranſverſales breves, likewiſe defend the capſular ligaments.

Obliqui inferiores.

1085. The obliqui inferiores or majores are true rotators of the head, by turning the firſt vertebra upon the odentoide apophyſis of the ſecond; all which alternate motions the head follows, without being hindered in the motions forward and backward in any degree of rotation.

1086. Theſe oblique muſcles cannot perform any other motions, being only aſſiſtants to the ſplenii and ſterno-maſtoidæi. The obliqui minores can have no ſhare therein, they being limited to the inflexion backward, as has been already ſaid. The obliquity of their direction, which may have deceived ſome anatomiſts, ſeems only to be contrived to make way for the inſertions of the complexi minores.

1087. Of the tranſverſales antici, the firſt only move the head in the manner above mentioned; neither can they perform any other motions, their inſertions being confined to the Os Occipitis and firſt vertebra. The tranſverſales antici ſecundi have no ſhare in the particular motions of the head, but ought rather to be ranked among the muſcles which move the vertebræ of the neck.

1088. The complexi minores belong to the head only by their ſuperior portions; the other portions belonging rather to the neck. They may ſerve alternately in the lateral motions of the head, and thereby co-operate with the ſplenius and ſterno-maſtoidæus of the ſame ſide, when theſe two act together; and they may likewiſe be of uſe to preſerve the capſular ligaments to which they adhere.

1089. The ſmall acceſſorii when they are found, have the ſame uſes with the muſcles to which they are ſupernumerary.

§ 13. *Uſes of the muſcles which move the vertebræ.*

1090. The particular motions of the neck ſeem always to be accompanied with thoſe of the head; but there are ſeveral of theſe motions in which the head is only carried along with the firſt vertebra, as if it adhered immoveably to it. The neck thus conſidered may be bent forward, ſtraightened, bent backward, inclined to each ſhoulder, and turned as on a pivot, by a rotation different from that of the firſt vertebra on the ſecond.

1091. The ſcaleni, when they act on each ſide at the ſame time may aſſiſt in bringing the neck forward, when we lean back in any reſpect. When thoſe of one ſide act by themſelves, they make a lateral inflexion either of all the vertebræ of the neck together, as in bending the middle of the neck; or of ſome only, as in bending the lower part of the neck alone. Theſe lateral inflexions cannot be made indirectly with the help of the inferior portion of the ſplenius.

Scaleni.

1092. The longi colli bring the neck forward by the lower part of the inferior portions. When one of them acts alone, or acts more than the other, this motion is more or leſs oblique. The remaining part of theſe muſcles has no hand in theſe motions, which ſeem to be peculiar to the laſt vertebræ of the neck on the firſt of the back.

Longi colli.

1093. By the upper and greateſt part of the lower portion they counterbalance the poſterior muſcles of theſe vertebræ and hinder the neck from bending backward by the contraction of the ſterno-maſtoidæi, when, lying on the back, we raiſe the head.

1094. It muſt here be remembered, that the natural ſituation of the bones of the neck is oblique on the forepart, and that the neck is bent in ſuch a manner, as that the convex ſide of the curvature lies forward, and the concave ſide backward. Therefore when we would hold the neck ſtraight, and bridle it, as it is called, this curvature muſt be deſtroyed. This is done by theſe two muſcles which in this caſe make an extenſion, in a manner, in oppoſite directions, and fix all the vertebræ of the neck cloſe to each other as if they were but one bone.

1095. The longus colli of one ſide performs theſe motions obliquely, and may likewiſe co-operate in the lateral inflexions of the neck with the ſcaleni and other muſcles which perform theſe motions, as we ſhall ſee afterwards.

1096. The tranſverſalis major, tranſverſalis gracilis, and the little tranſverſales, acting on one ſide, can have no other uſe but to bend the neck laterally; and to hinder theſe inflexions when they act on both ſides. The ſmall tranſverſales may likewiſe preſerve the capſular membranes of the joints from being compreſſed, or otherwiſe hurt by the motions of the oblique apophyſes.

Tranſverſales.

1097. The ſemi-ſpinales or tranſverſo-ſpinales of both ſides acting together, extend the neck upon the trunk, to keep it from inclining forward in ſtanding or ſitting, and bend it backward. The ſemi-ſpinales of one ſide acting alone, produce the ſame motions in an oblique direction, and in that caſe they are aſſiſted by the inferior or vertebral portion of the neighbouring ſplenius under which they croſs.

Semi-ſpinales.

1098. The ſemi-ſpinales of both ſides may likewiſe ſerve for the rotation of the neck, but then the inferior ſplenius of the oppoſite ſide muſt aſſiſt them. This motion is made in the ordinary ſituation of the neck, chiefly on the fourth and fifth vertebra. They may likewiſe perform the lateral inflexions of the neck, by aſſiſting the longus colli and anterior vertebral muſcles of the ſame ſide.

1099. The inter-ſpinales are aſſiſtants to the ſemi-ſpinales in their mutual action, and may

Inter-ſpinales.

likewiſe ſerve to bring back the neck to its natural ſituation, after ſmall motions of rotation.

1100. The vertebræ of the back are moved by being bent forward, by being extended or ſtraightened, and by being inflected directly or obliquely toward each ſide. The motion of rotation has no place here, becauſe of the particular ſtructure of the joints of theſe vertebræ and their connection with the ribs, which likewiſe hinder the flexion backward. Flexion and extenſion are the two principal motions, and much more apparent than the others.

1101. The flexion of the back forward is not performed by any particular muſcles, but depends, both in ſtanding and ſitting, on the relaxation of the muſcles that extend or ſtraighten it, and keep it in that erect poſture. In that caſe the weight of the head obliges the vertebræ to bend forward more or leſs in proportion to the degree of relaxation of the extenſor muſcles.

1102. To facilitate this flexion, we commonly raiſe the ſhoulders; which being done by the action of the ſerratus major, the rhomboides muſt be relaxed at the ſame time, by which the upper part of the back is left at liberty. The lower part is moſt eaſily bent, becauſe, the falſe ribs not being fixed by their anterior extremities, advance forward ſliding a little upon each other.

1103. When we lie upon the back or ſide, this flexion is performed chiefly by the abdominal muſcles; ſo that the greateſt part of the uſes of all the muſcles belonging to the vertebra of the back, is confined to extenſion alone.

Sacro-lumbares.

1104. The two ſacro-lumbares maintain the back and the regio-lumbaris in their natural ſituation when we ſtand or ſit; and, by the relaxation of their fibres more or leſs, the trunk is proportionably bent forward by the weight of the head and breaſt. They likewiſe extend the back and loins in all poſtures, keep them ſteady and fixed under the weight of burdens, and bend the loins backward.

1105. One of them acting alone, may have the ſame uſes of bending forward, extending, reſiſting and bending backward, but with leſs ſtrength, and in an oblique direction, as when the body is inclined obliquely forward, and to one ſide at the ſame time, or extended from that poſture. They likewiſe ſerve to counterbalance the oblique muſcles of the abdomen, in turning the thorax upon the pelvis, as mentioned N° 130.

1106. Theſe muſcles may in ſome reſpects be compared with the ſplenii; *i. e.* their ſuperior inſertions with the maſtoide inſertions of the ſplenii; and their inferior inſertions with the vertebral inſertions of theſe muſcles. The maſtoide portion of the ſplenius is longer, more diſtant from the articulation, and more diſpoſed to perform large motions, and to reſiſt great efforts than the vertebral portion. In like manner the coſtal portion of the ſacro-lumbaris, by the length of the tendinous ſeries, by their graduated inſertions in the ribs, and by their obliquity, is better diſpoſed for the uſes already mentioned, than the vertebral portion.

1107. The ſmall muſcular faſciculi which croſs theſe tendinous portions, called *muſculus ſacro-lumbaris acceſſorius*, ſeem to counterbalance and moderate the depreſſion of the ribs in the great efforts of the ſacro-lumbaris.

1108. The uſe of theſe muſcles in progreſſive motion, is not ſufficiently demonſtrated. It is ſuppoſed that while we lift one leg to make a ſtep, the ſacro-lumbaris of the other ſide ſuſtains the vertebræ of the loins and back, to prevent their yielding to the pſoas, which lifts the leg, and puts it in motion; but the direction of the greateſt part of the fibres of the ſacro-lumbaris is very improper for ſuch an uſe.

1109. The uſe of the ſacro-lumbaris in reſpiration is likewiſe attended with difficulties; for when the body is very much inclined forward, and even much loaded, the ribs continue ſtill to be raiſed with the ſame eaſe as they are depreſſed, though the ſcro-lumbaris is chiefly employed in this caſe; but it is to be remembered that I ſpeak here only of bending and loading the back, not of loading the ſhoulders. In the firſt caſe the ribs move eaſily, but not in the ſecond.

Longiſſimus dorſi.

1110. The longiſſimus dorſi is an aſſiſtant to the ſacro-lumbaris, eſpecially to the vertebral portion of that muſcle, which it helps very powerfully both by the multiplicity and inſertions of its fibres, in ſuſtaining the vertebræ of the back and loins while extended, whether in ſitting or ſtanding, and in preventing their ſinking under the weight of the body, or of any additional burden. It aſſiſts in performing and in counterbalancing all the motions and inflexions of which theſe vertebræ, eſpecially thoſe of the loins, are capable in all poſtures of the body; and in this it bears likewiſe ſome reſemblance to the inferior or vertebral portion of the ſplenius; and it muſt here be remembered, that theſe two muſcles on each ſide, and the ſacro-lumbares are of the number of thoſe called *vertebrales obliqui divergentes.*

Spinales et tranſverſales dorſi & lumborum.

1111. All the ſpinales and tranſverſales of the back and loins belonging to the claſs of the vertebrales recti, the ſpinales to the middle muſcles, and the tranſverſales to the lateral, according to the idea given of them when I ſpoke of the vertebral muſcles in general, their chief uſes muſt be to aſſiſt, moderate, and maintain the motions of extenſion and lateral inflection, whether ſimple and direct, or oblique and compound; much in the ſame manner as is done by the like muſcles of the neck.

1112. The ſpinales majores and tranſverſales majores have this peculiar to them, that their fleſhy portions not lying in a ſtraight line between their inſertions, they may perform not only direct motions when they act in even numbers, but alſo oblique motions when the numbers on each ſide are unequal. The ſmall ſpinales and tranſverſales being confined between two neighbouring vertebræ, cannot cooperate but in direct extenſions and inflexions.

Semi-ſpinales dorſi & lumborum.

1113. The ſemi-ſpinales or tranſverſo-ſpinales being oblique, converging, vertebral muſcles, are aſſiſtants to the ſacro-lumbaris and longiſſimus dorſi, which they croſs on each ſide. By this decuſſation joined to the multiplicity and graduated diſtribution of their inſertions, they increaſe the ſtrength of the other muſcles conſiderably, whether they act equally and uniformly with them, or alternately. The lumbar ſemi-ſpinales, called by the ancients *muſculus ſacer*, becauſe of their inſertions in the Os Sacrum, are more expoſed to motions and ſtrains than thoſe of the back, and are likewiſe larger and thicker. They are much better fitted than the ſacro-lumbares for ſupporting the pelvis on both ſides in walking, and on one ſide, when we raiſe the foot on that ſide, and ſupport ourſelves on the other.

1114. The quadratus lumborum and pſoas parvus are of the

Quadratus lumborum & pſoas parvus.

the ſame uſe to the vertebræ of the loins as the ſcaleni to thoſe of the neck. When both quadrati act, they keep the lumbar pillar ſtraight, that is, ſo as not to incline to either ſide, and then they may aſſiſt the recti of the abdomen in the inflexions forward, and the ſuperior portions of the obliqui in lateral inflexions.

1115. They may likewiſe ſerve to ſupport the haunches alternately in walking; and in ſtanding on one foot, the quadratus of the oppoſite ſide may ſupport the haunch of that ſide; in which action they co-operate with the tranſverſo-ſpinales and poſterior parts of the obliqui abdominis.

1116. The pſoas parvus when it is found, ſerves to ſuſtain the pelvis much in the ſame manner with the muſculi recti of the abdomen, in climbing, *&c.* But when we ſtand, we have no need of ſuch a ſupport, the pelvis reſting then upon the Oſſa Femoris, in ſuch a manner as that the largeſt portion thereof, and that which ſupports the whole body, lies behind that fulcrum, and the ſmalleſt part before. It may likewiſe ſerve to hinder the vertebral pillar from bending backward on ſome occaſions.

Coccygæus anterior.

1117. The coccygæus anterior may ſuſtain the coccyx in æquilibrio, and hinder it from being bent backward, and from being luxated in great ſtrains, as in the excretion of hardened fæces, *&c.*

Coccygæus poſterior.

1118. The coccygæus poſterior can only ſerve to replace the Os Coccygis when it has been forced backward, and to hinder it from being luxated backward.

§ 14. *Uſes of the muſcles which move the lower jaw.*

Temporalis.

1119. The two temporales acting together, raiſe the lower jaw, preſs the teeth in that jaw againſt the upper teeth, and pull it back when it has been carried ſo far forward, as that the lower inciſores get before the upper. They perform the laſt motion by their moſt poſterior portion which paſſes over the root of the zygomatic apophyſis, and the other motions by the co-operation of all their muſcular radii.

1120. The two maſſeteres ſerve to raiſe the lower jaw, and

Maſſeter. to puſh the lower teeth againſt the upper, in which uſe they co-operate with the temporales. They likewiſe bring this jaw forward by their external and largeſt portion; draw it back by their middle portion; and move it laterally by their ſuperior portions acting alternately. By the co-operation of all the three portions, they preſs the lower teeth againſt the upper.

1121. Both pterygoidæi interni ſerve to raiſe the lower jaw, to bring the lower teeth near the upper, *Pterygoidæus internus.* and to move the jaw laterally, as in grinding the food. They cannot bring the jaw a great way forward, in order to ſet the lower inciſores before the upper, and they can be of no uſe in bringing it back.

1122. The two pterygoidæi externi bring the lower jaw forward, in order to ſet the lower inciſores be- *Pterygoidæus externus.* fore the upper, in which action they are antagoniſts to the poſterior portion of the temporales, and the great portion of the maſſeteres. When one of them acts, it carries the chin obliquely forward, or turns it towards the other ſide. This oblique motion is performed alternately by theſe two muſcles acting ſingly.

1123. The two digaſtrici ſerve to depreſs the lower jaw, and to open the mouth; in doing which, the *Digaſtricus.* mechaniſm of theſe muſcles has appeared to all anatomiſts to be very ſingular, on account of their middle tendons, their inſertions, adheſions, and their manner of paſſing by another muſcle. The incurvation of this middle tendon has not only been looked upon as neceſſary to change the direction of the muſcles, but it has been believed, that, without this change of direction, they could not have depreſſed the jaw any further than the weight of the jaw would contribute to that action.

1124. This incurvation and paſſage has been compared to that of a rope over a pulley, without which advantage it was thought that theſe muſcles could not reſiſt the continual efforts of their powerful antagoniſts, nor overcome any exterior oppoſition, ſuch as that of the hand preſſing upon the chin. But when we examine carefully the ſtructure of the jaw and the inſertions of theſe muſcles, it appears evidently that their connection with the Os Hyoides is not neceſſary for the uſe aſſigned to them of depreſſing the jaw; as may be proved both on a ſkeleton and on a freſh ſubject.

1125. In a ſkeleton in which the motion of the lower jaw is preſerved by art, we need only tie a piece of packthread to the lower part of the chin where the digaſtricus is inſerted, and then keeping the lower jaw cloſe to the upper by any proper contrivance, paſs the other end of the ſtring through the maſtoide groove, and we will perceive, by pulling the ſtring in a ſtraight direction between theſe two places, that the jaw will be depreſſed.

1126. This experiment may be made without the help of a ſpring, or any other contrivance to keep the jaw ſhut, by ſimply inverting a proper ſcull, ſo that the lower jaw may by its own weight fall on the upper; for, by drawing the ſtring as before, the lower jaw will be raiſed, that is, parted from the other, and by letting the ſtring go, it will fall back again to its firſt ſituation.

1127. On a freſh ſubject the experiment may be made in the following manner. The connection of the digaſtricus with the Os Hyoides and muſculus ſtylo-hyoidæus being entirely deſtroyed; let it be pulled by its poſterior extremity directly toward the maſtoide groove, in the ſame manner as the ſtring was drawn in the foregoing experiments.

1128. Anatomiſts have not conſidered that the two rami of the lower jaw are crooked or angular levers, and that each digaſtricus paſſing by the angle in that bone, ought to be looked upon as being inſerted therein, ſo that the action of the lever is to be confined to that portion which lies between the angle and the condyle, without taking in what lies between the angle and the chin.

1129. It may be aſked therefore why the anterior inſertion of the digaſtricus reaches ſo far as the chin, ſince it might have been in the angle of the bone; and what is the uſe of its connection with the Os Hyoides, of its incurvation, and change of direction. The firſt queſtion is anſwered by calling to mind what has been ſaid about the extent or largeneſs of motion about the neceſſity of long fibres for large degrees of motion, and about lateral motions. Had this muſcle been inſerted in the angle, its fibres would not have been proportioned to the degrees of motion required, and for the ſame reaſon the lateral motions would have been obſtructed.

1130. In anſwer to the ſecond queſtion about the connection of this muſcle with the Os Hyoides and its incurvation, it is to be remembered that the digaſtricus has another uſe beſides that of depreſſing the lower jaw; which is to aſſiſt in deglutition, of which it is one of the principal organs. I demonſtrated this uſe of the digaſtricus above eight years ago in my public courſes in the phyſic-ſchools, and at the royal garden; but as the whole mechaniſm of deglutition cannot be explained till the tongue, larynx, and pharynx have been deſcribed, I ſhall only add in this place the following remarks, to prove the uſe of the digaſtrici in that action.

1131. We cannot ſwallow without raiſing the larynx or pomum Adami, as it is commonly called, at the ſame time, as every one may ſatisfy himſelf by laying his hand on that part of the throat in the time of deglutition. We are likewiſe obliged to keep the lower jaw raiſed while we ſwallow, and when it is depreſſed, we find that action impoſſible. Laſtly, the larynx cannot be raiſed but by means of its connection with the Os Hyoides; and the muſcles of that bone are too weak to reſiſt the efforts of the baſis of the tongue, and of the ſolid food which we ſwallow.

1132. Therefore while the temporal and maſſeter muſcles keep the lower jaw cloſely applied to the upper, in deglutition, the digaſtrici contract at the ſame time, as may be felt by putting the end of the finger upon the place where they are inſerted in the edge of the chin. And as the lower jaw remains immoveable, the digaſtrici are ſtreightened by their contraction, and by the connection of their middle tendons with the Os Hyoides, they raiſe that bone, and the larynx together with it.

1134. The force of theſe muſcles is very conſiderable, as may be ſhewn by laying the elbow on a table, and leaning with the chin on the hand, while we endeavour at the ſame time to depreſs the lower jaw; for as in that caſe this jaw cannot deſcend, the digaſtrici, by their inſertions in the apophyſis maſtoidæa, raiſe the upper jaw by bending the head backward on the condyles of the lower jaw. A piece of wood ſupporting the chin in place of the arm, will render this experiment more ſenſible and more certain. The involuntary motion termed *yawning*, is likewiſe a proof of the ſtrength of theſe muſcles.

1135. In the action of the digaſtrici in deglutition, we meet with one very ſingular phænomenon, of which there is hardly another example to be found among all the muſcles of the human body. For in all other inſtances, wherever antagoniſt muſcles act at the ſame time, they all co-operate in producing what is called a *tonic motion*; but in this caſe the levators and depreſſors of the lower jaw act together for different uſes; that is, the temporal and pterygoide muſcles are in action to raiſe the jaw, and to keep it in that ſituation, while the digaſtrici their antagoniſts perform an office which has no relation to that bone.

Contrivance of the interarticular cartilages.

1136. Two eminences in one bone articulated with two cavities in another, allow only of two contrary motions as in a ginglymus, and in the articulation of the Os Occipitis with the firſt vertebra. But the lower jaw, though articulated by its two condyles with the glenoide cavities of the Oſſa Temporum, has four direct motions, one forward, one backward, one downward, and one upward; and two lateral motions, one to the right, the other to the left. And laſtly, in all degrees of the direct motions, it may at the ſame time have any degree of lateral motions.

1137. This contrivance depends on the interarticular cartilages deſcribed among the freſh bones, N° 348. 349. In the lower ſide of each of theſe cartilages, there is but one cavity ſuited to the convexity of the condyle which it receives; and it is not turned directly downward, but obliquely backward; as the condyle is not turned directly upward, but obliquely forward. The upper ſide is hollow on the forepart, and convex on the backpart, anſwering to the articular eminence and foſſula of the Os Temporis.

1138. In the natural ſituation of the lower jaw, and while it remains in inaction, it is ſo diſpoſed, as that the anterior convexity of the condyles anſwers obliquely to the poſterior articular eminences of the Oſſa Temporum, and with this diſpoſition that of the interarticular cartilages agrees.

1139. In the direct motions upward, the cartilages ſlide backward and upward toward the meatus auditorius, the condyles ſtill continuing in the cavity of their lower ſides;

as is moſt evidently perceived when we preſs the teeth hard againſt each other; and the ſame thing happens in the direct motions forward. In the direct motions downward, the cartilages ſlide downward and forward; the condyles ſtill remaining in their inferior cavities, and the ſame happens in the direct motions backward.

1140. In the lateral motions, the condyles are carried alternately to the right and left ſides, and the cartilages follow their motions; ſo that the condyle on that ſide toward which the jaw is turned, juts outward, and that on the oppoſite ſinks inward; the prominent condyle having at the ſame time a ſmall motion backward, and the other condyle forward.

1141. From theſe obſervations we learn, that the ginglymoide motions of the lower jaw depend particularly on the inferior cavities of the interarticular cartilages, and that the motions forward, backward, and to either hand, depend on the upper ſide of theſe cartilages. The pterygoidæi externi move the lower jaw forward; the poſterior portions of the temporales move it backward; the left pterygoidæus internus turns it to the right hand; and the right pterygoidæus internus, to the left hand. The pterygoidæus externus of one ſide, and the poſterior portion of the temporalis of the other ſide, may at the ſame time perform the ſmall motions mentioned at the end of the laſt number.

§ 15. *Uſes of the muſcles which move the Os Hyoides.*

1142. The mechaniſm obſerved in the motions of the Os Hyoides, as well as in thoſe of the ſcapula, is very particular, and very different from what we find in all the other bones of the human body. All theſe bones have ſolid fulcra on which they are either moved or kept fixed by the proper muſcles, after the manner of a lever or otherwiſe; whereas the Os Hyoides is merely ſuſpended, having nothing to fix it but theſe very muſcles which move it in different manners.

Mylo-hyoidæus.

1143. The mylo-hyoidæus repreſents a moveable floor or bed, which ſuſtains the tongue with its muſcles and glands, and forms the bottom of the cavity of the mouth. When the two portions of this muſcle act together, they draw the Os Hyoides a little forward, and fix it in that ſituation, raiſing the whole tongue at the ſame time, and compreſſing the glandulæ ſublinguales. If one lateral portion acts more than the other, it puts the Os Hyoides in an oblique ſituation; and in a condition to ſerve as a fixed point for the motions of the tongue.

Genio-hyoidæi.

1144. The genio-hyoidæi pull the Os Hyoides much more forward than the mylo-hyoidæus; and as they are very narrow, and cloſely united together, there ſeems to be very little occaſion for one of them to act without the other.

Stylo-hyoidæi.

1145. The ſtylo-hyoidæi move the Os Hyoides upward and backward in a middle direction, between thoſe in which they lie; and they draw it more upward and backward when they act freely, that is, without being checked or confined by other muſcles, in the manner which we ſhall ſee hereafter. When one acts more than the other, the bone is moved obliquely.

Omo-hyoidæi.

1146. The omo-hyoidæi or coraco-hyoidæi act as the ſtylo-hyoidæi in a middle direction between the oblique directions in which they lie, and draw the Os Hyoides downward and backward, when they are not counterbalanced by the ſtylo-hyoidæi. When one acts more than the other, the bone is drawn obliquely to the right or left hand.

1147. When theſe muſcles and the ſtylo-hyoidæi act together, the Os Hyoides is drawn backward by a direct motion compounded of four oblique motions. This compound motion is directed more upward or more laterally according to the degree of action of the ſtylo-hyoidæi or omo-hyoidæi, or of any one muſcle of each pair; and in all theſe motions, the four muſcles are counterbalanced by the genio-hyoidæi.

1148. The length and direction of theſe two thin muſcles, as well as their inſertion in the ſcapula, deſerve our attention. To me it ſeems evident, that, for the uſes already mentioned, they could not have been inſerted any where elſe; and therefore that they are fixed in the ſcapula by a mechanical neceſſity, and muſt conſequently be very long. Their incurvated direction and ſituation behind the ſterno-maſtoidæi, enables them to perform their ſeveral motions in all the different poſtures of the head; the lateral motions not excepted; for when we turn the head to either ſide, the ſterno-maſtoidæus of the ſame ſide does the office of a pulley to the Omo-hyoidæus behind it.

1149. The ſterno hyoidæi draw the Os Hyoides directly downward, and ſerve to counterbalance the different motions of the ſtylo-hyoidæi, omo-hyoidæi, and genio-hyoidæi. They may in ſome caſes be aſſiſted by the ſterno-thyroidæi and thyro-hyoidæi, as we ſhall ſee hereafter.

Sterno-hyoidæi.

§ 16. *Obſervations on the co-operation of muſcles.*

1150. I took notice, N° 43. that in order to move any part, or to keep it in a determinate ſituation, all the muſcles belonging to that part muſt co-operate; and with reſpect to this co-operation, I diſtinguiſhed the muſcles into principal movers, moderators or antagoniſts, and directors or collateral movers.

1151. In N° 44. I obſerved that all theſe kinds are to be found in the articulations by enarthroſis, and in many of thoſe by arthrodia; but that in thoſe by ginglymus, the director muſcles are wanting. Laſtly, that in ſome caſes the moderators do not act; the want of their action being then ſupplied by the weight of the part to which they are fixed, or by the additional weight or reſiſtance of ſome other body.

1152. The remarks which were made on the motions of ſupination and pronation, N° 894. furniſh us with a very ſingular example of the co-operation of muſcles; and it is likewiſe evidently ſeen in the motions of the ſcapula on the trunk, and of the Os Hyoides. But it is chiefly in ſtanding, ſitting, progreſſion, and in the motions of the arm, that we obſerve the co-operation of a great number of muſcles proportionable to the ſituation of the parts.

1153. When we ſtand in the moſt common and natural way, the ſoles of the feet are placed horizontally as the common baſes of the whole body. To ſupport the legs like immoveable pillars upon this baſis, the muſcles which either cover or are fixed in them, muſt co-operate. The principal movers are the gaſtrocnemii and ſoleus; the moderators are the tibialis anticus, and peronæus medius and minimus; and the directors are the tibialis poſticus, and peronæus maximus.

1154. The legs ſupported in a vertical ſituation by the co-operation of all theſe muſcles, as by ſo many ropes more or leſs ſtretched, ſupport the Oſſa Femoris which are fixed in the proper ſituation by the action of the two vaſti and crureus; the rectus anterior being of no uſe to the Os Femoris in this ſituation. The vaſti and crureus are here the principal movers, and they act without moderators or directors; for as theſe bones are bent backward, the weight of the body ſupplies the place of very ſtrong antagoniſts.

1155. The thighs in this ſituation ſupport the pelvis: in order to fix which, the principal movers, moderators, and directors are all employed. But theſe different offices change in proportion as we ſtand more or leſs erect. When we ſtand very ſtraight, the co-operation of all the muſcles which can move the pelvis on the Oſſa Femoris, may be looked upon as uniform, or as a kind of tonic motion, eſpecially the co-operation of the glutæi, tricipites, recti anteriores, ſartorii, ſemi-nervoſi, ſemi-membranoſi, and of the bicipites chiefly when the head is a little inclined forward.

1156. The ſpina dorſi and thorax are ſupported in ſtanding by the co-operation of the vertebral muſcles and longiſſimi dorſi, which are here the principal movers; of the ſacro-lumbares, which are partly principal movers and partly directors, and of the quadrati lumborum, which are wholly directors. In this ſituation of the ſpine, the weight of the thorax and of the head, which naturally inclines forward, counterbalances the vertebrales, longiſſimi dorſi, and ſacro-lumbares, and therefore acts in place of moderators.

1157. The head and neck are ſupported in an erect poſture, by the proportionate co-operation of all the muſcles which move the head by itſelf, or together with the neck. The obliqui majores are the only muſcles which can be ſuppoſed to remain in inaction, while the head is kept ſtraight without moving either that or the neck.

1158. The ſplenii and complexi are here the principal movers, together with the ſpinales, and ſemi-ſpinales colli. The anterior vertebral muſcles of the neck are rather aſſiſtants than moderators in reſpect of the head, but with regard to the neck they are complete antagoniſts, without the aſſiſtance of which, the neck would bend forwards and the head fall backward, as has been already obſerved.

1159. In this poſture the ſterno-maſtoidæi act neither as flexors, nor as moderators of the uniform action of the ſplenii, complexi, and poſterior vertebrales; the actions of theſe muſcles being counterbalanced by the weight of the head. Yet the ſterno-maſtoidæus of one ſide, together with the ſplenius next to it; and the other ſterno-maſtoidæus and ſplenius likewiſe taken together are reciprocally principal movers and lateral moderators, aſſiſted by the tranſverſales and ſcaleni.

1160. From what has been ſaid about ſtanding, we ſee not only an eminent inſtance of the co-operation of muſcles, but the variety of their uſes, and the impropriety of their common denominations. The gaſtrocnemii, ſoleus, and tibialis poſticus are in this caſe extenſors of the leg, and not of the foot. The vaſti and crureus extend the thigh, and not the leg. The recti anteriores do not extend the leg, nor the ſartorii bend it, but are all employed in fixing the pelvis on the Oſſa Femoris.

1161. Progreſſion, or the motion of walking, demonſtrates ſtill more palpably, the co-operation of muſcles, and at the ſame time the variety of their functions. In that caſe the whole body is alternately ſupported on one lower extremity, while the other hangs in the air. This makes a kind of imperfect ſtanding, in which the co-operation of the muſcles is much the ſame as in ordinary ſtanding with reſpect to the foot, leg, and thigh; but with reſpect to the pelvis there is a conſiderable difference.

1162. To ſtand ſtraight on the two extremities, the pelvis is only to be kept from falling backward, and ſometimes from falling forward. But when we ſtand upon one extremity, the pelvis muſt not only be fixed upon the thigh, to hinder it from falling toward the ſide of the other raiſed extremity, but the ſpine muſt likewiſe be kept from inclining toward that ſide.

1163. The pelvis is ſupported in this caſe, by a very ſtrong co-operation of the glutæus medius and minimus, as principal movers; and by the glutæus maximus and muſculus faſciæ latæ, as aſſiſtants; and at the ſame time the ſpine is ſupported by the ſacro-lumbaris, latiſſimus dorſi, and quadratus lumborum of the ſame ſide.

1164. In ſitting, the pelvis reſts on the two tuberoſities of the Os Iſchium, and ſo cannot fall to either ſide; but it muſt be hindered from falling either backward or forward, which is done by the co operation of the recti anteriores, ſartorii, ſemi-membranoſi, ſemi-tendinoſi, and the long portions of the bicipites; and to theſe might be added the iliaci, the pſoai, both ordinary and extraordinary.

1165. Theſe obſervations are ſufficient to ſhew the uſefulneſs and neceſſity of being well acquainted with the co-operation of muſcles; becauſe, without this knowledge, it is impoſſible to explain the particular motions of ſome bones, or to diſcover or remove the diſorders or impediments to which theſe motions may be liable.

1166. I ſhall only mention one caſe to ſhew the importance of ſuch obſervations. A perſon complains of a pain at the lower part of the ſcapula, and that this pain is very acute in every motion of ſupination or pronation, though he keep the fore-arm bent, which is the moſt natural, moſt commodious, and moſt favourable poſture in this caſe, and holds it cloſe to his ſide, by means of a ſcarf, or otherwiſe.

1167. If we are not acquainted with the co-operation of the rotator muſcles of the Os Humeri, in the ordinary motions of ſupination and pronation, which I explained in giving the uſes of the muſcles which move the radius, we can never be able to explain or remove this diſorder.

1168. The common recourſe, when we are without this neceſſary knowledge, would be to indeterminate ideas of ſome communication between the nerves and veſſels of the fore-arm and thoſe of the ſhoulder; and the diſorder would be imputed to ſome obſtruction in the veſſels, or irritation or ſtrain of the nerves, *&c.* On this foundation, we would order the application of remedies to the parts anſwering to theſe veſſels and nerves; and when a great length of time had been employed in the cure, the true unknown cauſe would either diminiſh or quite diſappear of itſelf, or perhaps increaſe, and thereby occaſion other diſorders of worſe conſequence, and ſometimes mortal.

1169. But a perſon well acquainted with the muſcular co-operations, and who knows preciſely how to diſtinguiſh the muſcles proper for each co operation, can never commit ſuch miſtakes.

The End of the FIRST VOLUME.